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ABSTRACT

This document is a collection of 46 papers concerning the use of microcomputers in vocational education. Most of the papers relate hands-on experiences that vocational educators in various parts of the country have had with microcomputers in vocational education subjects, while others include suggested ways of coping with computer introduction, sources of computer software, and lists of computer programs that can be used for specific applications. Papers are arranged in the following 15 subject areas: administration, agriculture, basic skills and education, business education, computer literacy, counseling and student services, evaluating software, graphics, health, home economics, industrial education, marketing and distributive education, special needs, topics of interest, and word processing. A list of names and addresses of presenters and vendors at the conference at which this book was distributed completes the document. (KC)

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ED239051

MICROCOMPUTERS IN VOCATIONAL EDUCATION HANDBOOK

"A Collection of Papers and Other Information Related to Microcomputer Usage in Vocational Education"

Distributed At The
First Annual Microcomputers in Vocational Education Conference
In Madison, Wisconsin
August, 1982

U.S. DEPARTMENT OF EDUCATION
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Prepared by

Judith Rodenstein and Roger Lambert
Vocational Studies Center
University of Wisconsin-Madison
964 Educational Sciences Building
1025 West Johnson Street
Madison, Wisconsin 53706
(608) 263-4357

CE037876

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MICROCOMPUTER APPLICATIONS IN EDUCATIONAL PROGRAM PLANNING & DEVELOPMENT

Paper Presented at

American Educational Research Association

Annual Meeting

New York

March 1982

James M. Morgan
Planning & Development Branch
Department of Curriculum & Instruction
Cincinnati Public Schools

MICROCOMPUTER APPLICATIONS IN EDUCATIONAL PROGRAM PLANNING & DEVELOPMENT

James M. Morgan
Cincinnati Public Schools

Introduction

Unlike the original computer-assisted instruction "revolution" in the early seventies, the advent of microcomputers in the schools promises to make a lasting and significant change in the ways in which children learn. The ease of access and use of microcomputers together with the increasing availability of better quality software mean that students and teachers of the future will be as familiar and comfortable with the computer in their classrooms as they now are with pencils and chalk.

Even as this latest computer revolution is occurring in the schools, educators are finding many non-instructional applications for microcomputers as well. Student accounting, fiscal management, class scheduling, and other kinds of routine data management are some of these types of uses. Recently, in the Cincinnati Public Schools, we have been exploring some new applications in the areas of program planning, management and evaluation. This paper reports on some of these developments.

Background

Computer applications in education first began seriously in the late sixties with the initial development of computer-assisted instructional software, sometimes called courseware. These early CAI lessons were made to be run on large "main-frame" computers that had been designed primarily for business and scientific purposes. This software was often written by a computer programmer with little knowledge of learning principles familiar to educators. The programs ran slowly in very rigid formats determined by hardware limitations and the eccentricities of the Cobol and Fortran programming languages in which they were written. That is, if they ran at all. Quite often, teachers had to share computer time with other users making for frequent and inopportune periods of "downtime" for instruction.

However, one beneficial outcome of the inital CAI efforts in education was the development of computer-managed instruction (CMI) in which computers were used to monitor student progress in well-defined skill areas. Computer-based instructional management systems are capable of generating detailed reports to be used in making decisions about student placement, remediation, or advancement. The Cincinnati Public Schools has developed a highly successful CMI system called the Cincinnati Instructional Management System (CIMS) which has been adopted by a number of other school districts around the country.

In the past two to three years, educators have begun to explore seriously the use of microcomputers for instructional purposes. At this point, it is clear that hardware development, the capabilities of the microcomputers themselves, far exceeds software development, the courseware available to run on the computers. Some developers, notably the Minnesota Educational Computer Consortium, are beginning to publish high-quality software that goes beyond the original drill-and-practice applications of CAI to utilize the capacities of the microcomputer for tutorial and simulation activities as well as for teaching problem-solving and higher level thinking skills.

In addition to the many instructional uses of microcomputers in education, a variety of non-instructional applications have also been developed. These include student attendance monitoring, test scoring and grade reporting, class scheduling, and any number of fiscal accounting applications. While these uses have implications for educational programming, there has been little exploration of the potential of computers for program planning and development in education. This is in sharp contrast to the situation in the business world where computers are routinely used not only for inventory control, accounting, and other fiscal management tasks but also for planning and forecasting, resource allocation, and monitoring of project and program implementation. In the Cincinnati Public Schools, we have recently begun to explore and test these kinds of planning, development, and evaluation applications.

Approach

The Planning and Development Branch of the Department of Curriculum and Instruction in the Cincinnati Public Schools has the organizational responsibility for needs assessment, planning, and program development activities of the school district. As such, Branch personnel collect and analyze data and information from both the school and district-wide levels to assess program needs in the district. Branch members also develop short and long-range forecasts for the school system and identify promising program options. Once programs are developed and in place, Branch staff are responsible for directing and monitoring program activity, to see that it meets scheduled deadlines, and for updating decision-makers on progress. Finally, Branch personnel use process and outcome evaluation information to develop recommendations for program modification and further development. It is for these types of planning and development activities that microcomputer support is being developed.

For the past ten years, the Cincinnati school district has collected and stored information on a number of student, staff, administrative, and socio-economic variables for each of its sixty elementary and twenty secondary schools. This information has been kept on the district's main computer and used primarily for year-end or special reports. Data on a selected set of the variables that are best descriptive of individual school status are being entered into files on an Apple II microcomputer for use in a School Profile Program. The variables in the school profile include the following:

- average daily membership
- average daily attendance
- percent minority students
- reading achievement test scores
- math achievement test scores
- per/pupil expenditure
- pupil/teacher ratio
- percent low income students
- average years of staff teaching experience

The School Profile Program will allow an individual school file record to be displayed and compared to the average for all schools at its level on each of the variables. In addition, a group of schools within a specified range, e.g., those with attendance below 85% can be designated and their status on the other variables can be displayed. With this application, it is possible to identify special characteristics of schools within the specified range. See Appendix A for an example of this type of output.

Using this information, it can be determined whether schools with the specified characteristic differ significantly from the district-wide averages on the other variables of interest. Thus, it will be possible not only to pinpoint which schools are experiencing a particular problem but also to see what some of the other contributing factors might be. While this kind of information could be calculated from the year-end reports, the advantage afforded by the School Profile Program is the immediate access provided to the data and the ability to call out any combination of school variables for inspection.

A second application that is being developed in the area of planning is a trend analysis/forecasting program. This program uses individual school files containing data from the past five years on the same set of variables listed previously. Two types of output will be available from the program. The first shows a regression line for the past five years on any of the variables. This trend line will show whether a school or subset of schools has experienced an overall increase or decrease in the factor of interest in the previous five years.

A second type of output from the program is the extrapolation of future trend lines for a particular variable. Using the five-year historical data for a school, the regression line is extended for a three to five year period to show the direction of the variable if no intervention occurs at the school. For example, the rate of decrease in reading or math achievement for a particular school can be projected for the next five years assuming that the rate for the previous five years holds. The same type of projection could be made for a group of schools. See Appendix B for an example of this type of report.

At this time, trend lines for only one variable at a time can be determined. It is planned to program the Apple microcomputer to develop trend lines using a combination of variables in a multiple regression format. However, even the present program capability allows predictions to be made regarding future performance at a school in order to determine whether intervention with a special program is necessary. Thus, if attendance at a particular school is predicted to drop below a certain unacceptable level, a program may be instituted, the results of which could be measured against the projected trend line for the school.

Another program capability under development is one which will illustrate the effect of specific program interventions on a school variable. Using data obtained from previous experience with other schools, the effect of a program on a school variable could be simulated to observe its estimated effect. Thus, it would be possible to show the effect of a special reading program on reading achievement for a school experiencing low reading test scores. The effects of combinations of variables could also be programmed to give a more realistic picture since interventions rarely occur in isolation from other effects.

A third type of application that is under development for the Apple is a program for producing PERT charts. This program will adapt currently available software to produce schedules of project activities using the Critical Path Analysis method to determine appropriate activity timelines. The projected number of days for each of the project tasks will be entered into the microcomputer and the program will determine a minimum, optimal, and maximum time duration for the entire project. Output from the program will include a PERT network showing the interrelationship of project events, and a listing of project activities with beginning and completion dates and persons responsible for each activity.

A fourth application has been in use in the Cincinnati schools this year to provide a continual monitoring and updating function for program implementation. In the Cincinnati Public Schools, goals and subgoals are set for the entire district each year. The Goal Management Report program provides video or print output of the current status of subgoal progress at the task level. Reports are sent to subgoal managers for updating and their responses are entered directly into the Apple microcomputer. Output shows the number and description of each task related to a subgoal, the beginning and completion dates, person responsible, and the current status of the task. An example of this report is shown in Appendix C.

Updates are prepared on a bi-monthly basis for goal managers. It is planned to use the same program to monitor implementation of a long-range plan for the school district that is currently under development. The same program may be used to monitor implementation of state and federal programs in the school district.

Finally, the evaluation function is probably the most common purpose served by computers. However, until recently, there have been few quality programs for statistical analysis of educational data. Most of the statistical packages that have been written for the Apple microcomputers were developed for business or technical use and do not have the flexibility of the SPSS and other large computer packages. In Cincinnati, we have been writing statistical programs to run on the Apple as the need arises. These include parametric and non-parametric measures of simple effects and correlations that also use the graphics capabilities of the Apple to plot data points. For example, included in the program that computes the Pearson product-moment correlation is a function for printing out the scatterplot and regression line of the two variables. The programs also allow for the data to be input from disk files or directly from the keyboard. Eventually, it is planned to enable the statistical programs to access the school variable files described in the earlier applications so that statistical tests can be applied directly to the profile and trend analysis output from those applications.

Summary

The possibilities for microcomputer support for educational planning and development are just beginning to be explored. The applications described above are in various stages of development, from initial planning and programming to full usage. One important lesson that has been learned is the tremendous amount of development time it takes to write "bug-free" programs that produce the desired output in a useful format. As we continue to develop and test these applications for needs assessment, forecasting, and program planning and monitoring, we will be evaluating their effectiveness in improving program development on a district-wide basis. It is expected that the results will show a significant improvement in our ability to plan and develop effective educational programs for the Cincinnati Public School system.

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Melmed, A.S. "Information Technology for U.S. Schools." Phi Delta Kappan, January 1982, pp. 308-311.

Moore, M.H. Cincinnati Instructional Management System, Handbook for Teachers (Reading and Mathematics). Cincinnati Public Schools, 1975, 1981.

Morgan, J.M. "Computer Assisted Instruction for Blind and Deaf Children." Paper presented at AERA Annual Meeting, 1978.

Parry, R. "Hard-Hat Management: Two On-Site Tools." Interface Age, February 1981, pp. 71-72+.

- "Administrators Find Apples Simplify Routine." Apple Education News, June 1981, pp. 1-2.

APPENDIX A

CINCINNATI PUBLIC SCHOOLS
PLANNING AND DEVELOPMENT BRANCH
SCHOOL PROFILE PROGRAM

VARIABLE	SCHOOL RECORD N=1 *	SCHOOL DISTRICT AVERAGE N=12
1. Average daily membership	635	575
2. Average daily attendance	89.9%	84.3%
3. Percent minority students	28.1%	55.3%
4. Reading-percent at or above median	42.6%	38.9%
5. Math-percent at or above median	45.8%	42.7%
6. Per pupil expenditure	$2004.	$2224.
7. Pupil/teacher ratio	20.3	18.4
8. Percent low income students	29.6	54.5
9. Average years of staff teaching experience	15	13

* Sample junior high school

APPENDIX A (Cont.)

CINCINNATI PUBLIC SCHOOLS
PLANNING AND DEVELOPMENT BRANCH
SCHOOL PROFILE PROGRAM

VARIABLE	SCHOOL RECORD N=5 *	SCHOOL DISTRICT AVERAGE N=12
1.Average daily membership	818	575
2.Average daily attendance	80.9%	84.3%
3.Percent minority students	57.7%	55.3%
4.Reading-percent at or above median	21.5%	38.9%
5.Math-percent at or above median	25.9%	42.7%
6.Per pupil expenditure	$2163.	$2224.
7.Pupil/teacher ratio	18.9%	18.4
8.Percent low income students	84.3%	54.5%
9.Average years of staff teaching experience	14	13

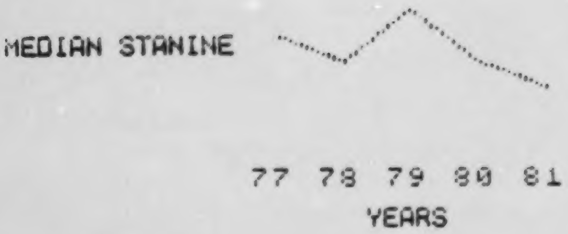
* Junior high schools with less than 85% average daily attendance

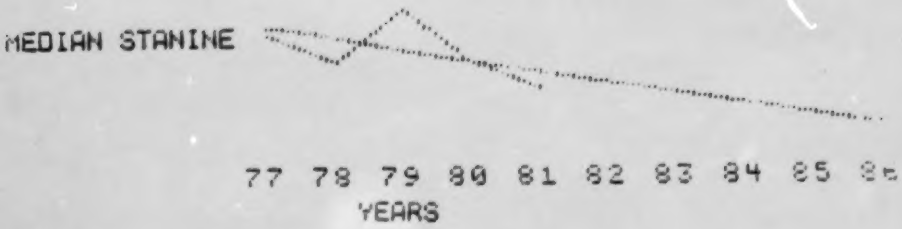
APPENDIX B

CINCINNTI PUBLIC SCHOOLS
PLANNING AND DEVELOPMENT BRANCH
TREND PROGRAM

READING ACHIEVEMENT *

YEAR	PROFILE VALUES
1977	5.1
1978	4
1979	5.8
1980	4.1
1981	3.5
	PREDICTED VALUES
1982	3.5699978
1983	3.25999706
1984	2.94999633
1985	2.6399956
1986	2.32999487





* Sample school

APPENDIX C

SUBGOAL MANAGER: J. GRATE REPORT DATE: 01-27-82

SUBGOAL # 1.01 IMPLEMENT THE MINIMUM COMPETENCIES INSTRUCTION TESTING & COMMUNICATION COMPONENTS DISTRICT-WIDEAT GR.3 & CONTINUE FIELD TESTING & PLANNING AT GRS. 6 & 9

TASK #	TASK DESCRIPTION	PERSON RESPONSIBLE	START DATE	COMPLETE DATE	STATUS
1.01.01	PLAN & CONDUCT TRAINING FOR ADMINISTRATORS SUPERVISORS & TEACHERS	J.GRATE	09-05-81	04-15-82	COMPLETED
1.01.02	ORIENT PARENTS & COMMUNITY TO THE MCP & PROVIDE HELP FOR PARENTS	CCC	10-06-81	05-30-82	IN PROCESS
1.01.03	PROVIDE MCP MATERIALS FOR ALL GR.3 CLASSROOMS & FOR GR.6 & 9 PILOT SCHOOLS	J.WALTER	08-01-81	05-30-82	COMPLETED
1.01.04	DEVELOP & IMPLEMENT MONITORING ACTIVITIES FOR THE INSTRUCTION TESTING & COMMUNICATIONS COMPONENTS	J.GRATE	09-15-81	06-11-82	IN PROCESS
1.01.05	CONDUCT SPRING MCP TESTING IN ALL GR.3 CLASSROOMS & IN PILOT SCHOOLS GRS. 6 & 9	Z.AHMAD	03-15-82	07-15-82	TO BEGIN
1.01.06	DEVELOP PLANS FOR REMEDIATION PROGRAMS	GRATE ET AL	09-15-81	06-15-82	IN PROCESS
1.01.07	PLAN SYSTEM-WIDE EXPANSION OF MCP FOR GRS. 6 & 9	J.GRATE	01-02-82	06-11-82	TO BEGIN

Will be published in book form
in Spring 1983 by the
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Alameda Co. Supt. of Schools Office
685 A Street
Hayward, CA 94541

**ALAMEDA COUNTY
SUPERINTENDENT
OF SCHOOLS**

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SUPERINTENDENT

ARTHUR O. BACHELOR
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BUSINESS SERVICES

RAUL JARAMILLO
ASSISTANT SUPERINTENDENT
ADMINISTRATIVE SERVICES

HARLEY L. SORENSEN
ASSISTANT SUPERINTENDENT
INSTRUCTIONAL SERVICES

SELECTING and BUYING ADMINISTRATIVE SOFTWARE

The information in this list came from two main sources: the Dresden School Microware Catalog, and "Microcomputer Software for School Administration," from MicroSIFT. The School Microware Directory is $25/year for 4 catalogs from:

Dresden School Microware
P.O. Box 246
Dresden, ME 04342

Their catalog contains short descriptions/summaries of the software. MicroSIFT is a N.S.F. funded software evaluation project which publishes information from time to time on various aspects of microcomputer software. Their address is

MicroSIFT
NWREL
300 S.W. Sixth Ave.
Portland OR 97204

In addition to the products listed here, which are specifically for school administrative tasks, there are many business programs which may be adaptable for school use. In addition, there are many good data base programs which can be used for a variety of school administrative tasks; to select one for your use, contact your local dealer and discuss your needs. Word processors are also useful; if you chose a word processor and a data base which can share files, you can use the data base to sort information for form letters produced with your word processor. Visicalc is a useful budgeting tool, which is flexible enough that many other school uses have been found.

To purchase one of the programs in this listing, contact the source listed or your local dealer for information about the product to see if it will fit your intended use. Then ask for at least one contact school using the software, and talk to them about their use and satisfaction with the product. It's your money--take the time to spend it wisely and get software which will work for you! If there is not a school nearby, arrange for a demonstration. Take sample information from your school to try with the program.

Some sources offer training with their software; it's usually a good investment. Check on the capability to create backup information. Also ask what kind of support is available to users; can you get help in an emergency? Lastly, don't buy by price.

Prepared by Glenn Fisher, School Computer Specialist
Alameda County Superintendent of Schools Office
685 A St., Hayward, CA 94541, 3/82

ADMINISTRATIVE SERVICES DIVISION
224 WEST WINTON AVENUE
HAYWARD, CALIFORNIA 94544
(415) 881-6201

BUSINESS SERVICES DIVISION
384 OCIE WAY
HAYWARD, CALIFORNIA 94541
(415) 881-6040

INSTRUCTIONAL SERVICES DIVISION
685 A STREET
HAYWARD, CALIFORNIA 94541
(415) 881-6288

ADMINISTRATIVE SOFTWARE for the APPLE

Addison Wesley
Sand Hill Rd.
Menlo Park 94025

Bursar, Equip,
Purchase
Management sys.

Advanced Technology
4296 Tambor Ct.
San Diego 92124

Test Bank (computer not named)

Applied Ed. Systems
RFD#2 Box 313
Dunbarton NH 03301
603-774-6151

Course Sched.
Daily Atten.
Grade Report

Avant-Garde Computer
P.O. Box 30160
Eugene OR 97403

A.E.N. Grading
Mailing & Filing

Bell & Howell
7100 McCormick
Chicago IL 60645

Grade System

C.B.S. of Myrtle Pt.
1707 View St.
Myrtle Pt. OR 97458

Payroll
Fund Acctg.
Student Records
Accts. Payable
Test Generator

COMPress
P.O.Box 102
Wentworth NH03282

Grader

Computer Plus
Fremont & Mary
Sunnyvale CA 94087
408-735-1199

Apple Sauce
Attendance Acct.
System

CQE Project
Ortonville P.S.
Ortonville, MN 56278

Attendance
Disbursement
Payroll
Revenue

Creative Computing
P.O. Box 789-M
Morristown NJ 07960

Apple Gradebk.

Cupertino U.S.D.
c/o E. Amundsen
10301 Vista Dr.
Cupertino CA 95014
408-252-3000

Proficiency Test

Data Proc. Consultants
2405 San Pedro N.E.
Albuquerque, NM 87110

Immunization

Earle Assoc.
P.O.Box 12213, Loiza Sta.
Santurce, Puerto Rico 00914

Student Records
Student Registr

Educational Activities
P.O. Box 392
Freeport, NY 11520

Readability
Grade Averages

Ed. Admin. Data
2241 Greenbriar
Springfield IL 62704
217-787-7190

School Attend. (Scantron)

Ed. Micro Assoc.
Box 787
Palo Alto CA 94302

Transcripts

Ed. Services
P.O. Box 12599
Research Tr. Pk. NC 27709
919-781-1500

Attendance

Evans-Newton Inc
7745 E. Redfield
Scottsdale AZ 85260

Project BASIC (competencies)
Project TIME (std. test scores)
Project TEST (local test scores)
Project ATTEND (attendance)
Project lEP (Sp. Ed. objectives)

G2 Compuscience
P.O.Box 683
Mauldin SC 29662

Alphabetizing
Lab Inventory, Perm. Grades

J.L. Hammett
P.O.Box 545, Hammett Place
Braintree MA 02184

Library/Overdue

Holt-Rinehart
839 Mitten Rd.
Burlingame CA 94010
415-692-6380

CLASS
(class mgt.)

JEM Research
Discovery Park
P.O. Box 1700, U. of Victoria
Victoria, B.C. Canada V8W 2Y2

Attendance
Demographic
(student rec.
Textbook Invent

K-12 Micromedia
P.O. Box 17
Valley Cottage NY 10989

Libr. Circ. Mgt

Library Software
P.O.Box 23897
Pleasant Hill CA 94523

Library Circ.

Mann & Assoc.
7594 San Remo Trail
Yucca Valley CA 92284

Attendance, Class Schedul.
Counsellor's prog., Grade Book
Grading Systems, Mailing List
Proj. Plan & Budgeting

MEAN
256 N. Washington
Falls Church VA 22046
703-536-2310

Student Mgt Sys
(sp. ed.)

MECC
2520 Broadway
St. Paul MN55133
800-631-8112

School Utilities
Vol. 1 (salary
enroll, revenue
projections)

MITIE, c/o Jim Rose
School of Ed.
U. of Colorado
Boulder CO 80309

Enrollment Projections
Logistics Forecasting

Microphase
3014 Scott Blvd.
Santa Clara CA 95050
408-727-3688

Attendance
Test Scoring
Survey Analys.
(requires Scantron)

Monument Computer
Village Data Ctr
P.O.Box 603
Joshua Tree CA 92252

Assistant Prin.
(sched, grade, records, attn.)
Roll Call

OMNICO
300 Buckeye Rd.
Atlanta GA 30341

Registrar

Random House, School Division
2970 Brandywine
Atlanta GA 30341

Attendance, Career Info.
Instr. Mgt., Math Mgt. Prog.
Reading Mgt., Readability

Microdynamic Ed. Systems
2360 S.W. 170th
Beaverton, OR 97005

Faculty& Staff, Student Body
Individual Lesson Plans
Budget Records
Overdue Books, Periodicals
Equipment Inven., Supply Invent.
(requires DB MASTER)

Microlab Learn.
2310 Skokie Val.
Highland Pk. IL 60035

Data Factory

Micro Power & Light
1444 Keystone Pk
13773 N. Ctrl. Expressway
Dallas Tx 75243

Grade Book

Mt. View Elem.
12401 N. Perry
Broomfield CO 80020

Card Catalog (Corvus reqd)

Pegasus Computing
Herengracht 566
1017CH Amsterdam,Netherlands

Rostar (scheduling)

Stoneware Prod.
1930 Fourth St.
San Rafael CA 94901

DB Master

Teck Assoc.
P.O. Box 8732
White Bear Lake MN 55110

Catalog Writer

UNICOM
297 Elmwood Ave.
Providence RI 02907
800-556-2828

Grade Reporting

===

ADMINISTRATIVE SOFTWARE for the TRS-80

Addison Wesley
Sand Hill Rd.
Menlo Park CA 94025

Bursar, Equip, Purchase
Management sys.

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4296 Tambor Ct.
San Diego CA 92124

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Grade Report

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427 W. Park Av.
Bridger, MT 59014

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Scheduling, Staff Accounting
46 other misc.

C.B.S. Myrtle Pt.
1707 View St.
Myrtle Pt. OR 97458

Accts. Payable, Fund Acctg.
Payroll, Student Records
Catalog Card Printer
Test Generator

Computer Services
395 S.W. Sixth
Gresham, OR 97030

Testing, Statistics
Survey, Mailing

Desert Sound
16268 Main St.
Hesperia CA 92345
714-244-2555

Reader (forms reader driver)

Educational Activities
P.O. Box 392
Freeport NY 11520

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Mod. School Attendance
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Math Mgt. Prog., Readability
Reading Management
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Software Qual.
Box 50083
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(student data base)

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Atheletic Director's Right
Hand (sports records)

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Rindge NH 03461

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Grade Report

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Attendance & student records
Scheduling

Comm Data Sys.
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School Adminis.

Dr. Daley Software
425 Grove Ave.
Berrien Sprs. MI 49103

Inventory, Data Base

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P.O. Box 392
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Test Data Mgt.

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Project TIME (std. test scoring)
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(class mgt.-test/objectives)

K-12 Micromedia
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SCHEDULING COMPUTER USE IN A SCHOOL

Some advance preparation and planning will allow many teachers in your school to enjoy using the computer while avoiding some pitfalls and problems that can leave a computer gathering dust in a corner.

Firstly, you will have to realize that, like starting any other program, starting computer use in a school will take a lot of somebody's time and energy. Hopefully, this information will save some of that time. You will definitely need at least one person in your school who is willing to put in the time and energy. Two people are better, since you can support each other and share the work. This person can be a parent, aide, teacher, or principal. The more people you can get to help and support you (and incidentally, to be enthusiastic about computers), the easier your job will be. Your supporters may be in another school, in a users group, or even correspondents.

One way to build support is to let people take the computer home during evenings and weekends with some friendly programs, so they can get acquainted. Another way is to set up small group workshops where people can get hands-on experience with your assistance.

Once you have a person committed, you will need to:

1. acquire a library of programs
2. set up and maintain a schedule of use
3. train users
4. take care of problems
5. support other teacher's growth in use & knowledge

Here are some suggestions of ways to meet these needs and build a successful program:

ACCUMULATE A LIBRARY

There are basically two ways to obtain programs--to copy free public domain programs, and to buy copyrighted programs. What your library will ultimately consist of depends upon how much money and time you have available, and upon how picky you are. Public domain programs are cheap, take lots of time to copy (usually yours), and are generally of low quality. Copyright programs are costly, take little time, and vary in quality from poor to high. Public domain programs can be obtained from users groups at meetings, from some District Offices or County Offices of Education, at conferences featuring software exchanges, or from Computer Using Educators "SOFTSWAP." Some school districts have groups of teachers or of teachers and students who write computer programs for use in the district (and occasionally, for sale outside the district.)

Purchasing copyrighted programs often leaves you in a state of suspense, because you may have to shell out money, sight unseen. Some software is available for preview at some County Offices of Education, or on preview order from the seller. Some periodicals review software. The COMPUTING TEACHER and the CUE Newsletter are 2 good sources of reviews of educational software. Other owners of similar machines in your county or district are good sources of information about good programs. Please do not copy copyrighted software from other users or allow other people to copy yours. It is illegal, and will result in no good software being available, since authors will only write if they can get money for their work. If it's good--BUY IT! The Alameda County Office of Education has a collection of public domain software which may be copied, as well as extensive files of catalogs of software. The School Computer Specialist is available to help you choose programs. Do make sure you make ONE copy of each program as you obtain it, giving you a backup copy in case your original is damaged.

SCHEDULING

Once you have some programs to use, you will need to set up a way for teachers to use the computers. You will also need to be sure every teacher who wants the computer gets a chance to use it. First you will need a schedule. Teachers have a lot of demands upon their time, so usually they will want a fixed schedule where they always get the computer on the same day, or at the same time. You may not be able to schedule all your teachers on this type of schedule, so here are some other schedules which have worked. On a fixed weekly schedule, each teacher gets a minimum of 1 hour at the same time on the same day each week (for example, Mondays from 10-12). A rotating schedule gives each teacher the same day of the week for a month, then a new set of teachers are scheduled (example, Tuesday all day, in November) or each teacher can get the same time every day for a month (8:30-10), then the next group of teachers get scheduled. Obviously, a "month" can be 3 or 5 or 8 weeks depending upon the number of teachers using the computer at your school.

You will also need to find out what programs teachers want to use. It is helpful to have a list of programs available, with short descriptions, so a teacher does not have to sit down and use every program in the library. One effective procedure is to circulate the schedule near the end of the week and have teachers write the name of the program they wish to use the following week next to their name on the schedule. If they trust you, they can simply write down the subject and let you choose a program. This is a good way to start, since you can pick "showoff" programs to start at a high interest level. It is important to involve teachers in choosing programs as soon as possible, since it makes the computer seem more "theirs," and allows you to involve them in discussion about how the computer fits in and is being used in their class.

Once you have your schedule with choices of programs, make copies and distribute them to the teachers and your student proctors (or whoever is overseeing the computer).

STUDENT PROCTORS

Now you know when the teachers are going to get the computer; you have to deliver it. Teachers are busy people, and having someone else responsible for the computer makes life easier. Students are available, interested, and can be trained to be in charge of the computer when it goes to other classes. By assigning one student to each class (or to a certain day and time), none miss too much classroom work. The assignment can also be a reward for both high achievers and those who need peer approval. It is very important to beware sex bias--boys will intimidate the girls and clamor for the jobs, but girls are competent, and everybody needs the modeling of girls in charge of computers.

Where do you find these students? Those with computers at home are a natural choice; a scout unit working on a computer badge, or a computer club are other possibilities. However, the skills are easy to learn and virtually any student can be taught to be a computer proctor. In a K-6 school, 5th and 6th graders are good material. It can be useful to choose the proctors from the rooms of several cooperative teachers--this helps involve others with the computer, it spreads the work around, and provides built-in proctors in the participating classrooms.

The proctors need to be trained to handle both the machine and its users. They must be shown, and practice, how to load programs, how to deal with common operating problems (like pressing "BREAK" instead of "ENTER"), how to show others how to use the computer, and perhaps most important, how to help younger or less knowledgeable students using the computer. Once trained, they need to practice--in your room, with you and your students, so you are sure they know what to do. Then they're ready to go out with the computer. For primary classes (K-3), have them stay with the computer. They can assist the younger children with reading directions and typing their names, and also help them follow the class schedule. For older students, after a few days, the proctor will simply need to set up the computer and start the program; then they will be "on call" if there are problems. These proctors can even train new proctors in other classrooms. Some schools give a certificate to proctors when they have been trained and have demonstrated their skill. You may have to try several ways of assigning proctors until you find a schedule which provides enough support for the teacher, doesn't take much of your time, and doesn't take your proctors out of too much class time. Properly set up, all you have to do is post the teachers' choice of programs each week, and the proctors will do the rest.

TAKING CARE OF PROBLEMS

Three general types of problems may arise, and you will cope better if you are prepared. The types are hardware, software, and people. Hardware problems can range from a stuck key (wiggle it gently), to serious electronic problems. If you bought your computer from a local store (and it's a very good idea), contact them for help, and, if necessary, for service. Most problems are minor, and you can really fix them yourself. Loose or dirty connections seem to be one of the biggest problems, and plugging whatever it is back in, or rubbing contacts with a clean pink eraser often does the trick.

Software problems can be taken care of mostly with some simple operational steps. If someone knows how to program, they can help you with recurring or more perplexing problems. Sometimes your copy may have been damaged (touched by dirty fingers, mangled or stretched tape), and you will need to make a new copy. Commercial software should work properly and usually contains instructions about what to do if there are problems. Some public domain software is poorly written and full of problems. Usually, what seems to be a software problem is really a problem following directions, or in using the machine improperly (such as pressing "ESC" instead of "CTRL").

People are the biggest problem--they may be afraid of the computer, resent it, or have other strong feelings about it. The best cure is a well-organized program and no pressure--if they don't want it, don't force them. Give them time to see how excited students and other teachers are. Usually, they will become interested and ask to participate if they haven't been pushed or intimidated by hard sell or too much enthusiasm.

SUPPORTING OTHER TEACHERS

Listen to teachers' comments about use; if they're unhappy, the schedule may need some revision, or perhaps they need more help in choosing software. They also may be ready for a workshop or be interested in some time to talk about computer use. You will need to be aware of your faculty's changing needs, and meet them by individual or group activities. Share information you have with others who are interested; invite them to users group meetings. Above all, do everything you can to make it possible for teachers to take computers home and use them in that neutral setting. Hopefully, you will soon have a school full of computer users!

Prepared by: Glenn Fisher
School Computer Specialist
Alameda County Office of Education
685 A St., Hayward CA 94541
5/81

Role of Computerized Instruction
in Secondary Vocational Agriculture Education Programs

by

Anna Beth Neason
Agricultural Education Department
Iowa State University
Ames, Iowa

June, 1982

Introduction

Education has moved into the computer age with great controversy, problems, and promises. Computers are being used extensively in agriculture, government, business and other areas of society for all types of information processing as well as design and problem solving. All aspects of education, including agricultural education, have become concerned with the use of computers to enhance learning. Questions are being raised about computerized instruction's usefulness, its role within the curriculum, and its capabilities to enhance learning.

Although studies of computerized instruction in education have been conducted since 1960 (Hallworth and Brebner, 1980), agricultural educators have only recently begun to consider its use in vocational agriculture programs. A few teachers are currently using computers for record keeping, but the broader uses of computerized instruction have largely been ignored.

A review of literature reveals several labels and definitions for computerized instruction. Computer assisted instruction and computer managed instruction are two commonly used categories (Jelden, 1980). In this paper, computerized instruction (CI) refers to uses of the computer for instruction of individuals or groups of students. These uses include five software (program) categories: experiential, informational, reinforcement, integrating and tools (Thomas, 1982). Experiential programs use discovery methods; they set the stage for future learning. Informational programs are similar to programmed text; they present information to the student and then test the student's understanding. Reinforcement programs are essentially drill and practice exercises. They are a series of stored exercises for the student to complete. Integrating programs allow students to apply previous knowledge and experience with new knowledge to solve a problem. Computer simulations are integrating programs. Tool programs facilitate and speed up processes learned previously. They permit students to tackle complex, realistic problems by minimizing the need to focus on computations

Statement of the Problem

Computerized instruction can be a viable tool for vocational agriculture programs. But, agricultural educators must decide one important question. What is the role of computerized instruction in secondary vocational agriculture education programs? This paper considers why CI should be used in vocational agriculture, current uses of CI in education and the role of CI in vocational agriculture. Due to the breadth of the topic, this paper considers only the potential use of CI with secondary students in vocational agriculture.

Importance of the Problem

Computers are an integral part of all career areas, including agriculture. Farmers are using computers to maintain and analyze production records. Dairymen and feedlot operators maintain individual animal records to generate specific feed rations for maximum production. Systems such as AGNET provide up-to-date market information for analysis and decision making which can increase farm income (Foster, 1982). Systems analysis programs aid management decision making on the farm and in agribusinesses. Agribusiness uses computers for information processing of inventories, consumer mail lists, and business communications as well as in record keeping and analysis. Thus, future agriculturists need computer literacy skills to prepare them for future careers in agriculture.

Instructional improvement is another reason for computerized instruction in vocational agriculture. Use of CI improves student achievement and attitudes, and it can reduce instructional time (Chambers and Bork, 1980). Students enjoy CI because the computer is patient, wrong answers do not cause embarrassment, and instruction is fitted to the student's own pace (Broussard, 1981). CI has been shown to be superior to lecture and to programmed text learning. In one study, student achievement using CI was 18% higher than lecture and 7% higher than programmed text (Deignan et al., 1981). Vocational agriculture cannot ignore teaching methods that improve student achievement and attitude.

Computer Instruction in Education

Computerized instruction studies began in 1960 with the PLATO project at the University of Illinois, Urbana (Hallworth and Brebner, 1980). Early programs such as PLATO, the Stanford University program, and the TICCIT program were based upon either mainframe computers or minicomputers. Both systems were too expensive for most public schools' budgets. Only the larger school districts, who could afford time-share costs, were involved in these programs. In 1970, a national survey showed only 13% of the secondary schools in the United States used computers for instructional purposes (Chambers and Bork, 1980). In 1975, the first microcomputer was developed. Microcomputers are stand-alone, table top computers that sell for $500 to $4,000 (Doerr, 1979). The microcomputer helps make CI feasible for all schools, regardless of size (Hallworth and Brebner, 1980).

Studies show CI to be effective for many types of disadvantaged students, including those with developmental handicaps, learning disabilities, and/or retarded learning capabilities (Hallworth and Brebner, 1980). But, it should be noted that CI benefits all students, including "gifted" students. Most CI courseware development has been for math, language, and reading at the elementary school level. Major or even minor studies in CI for agricultural and/or vocational education have not been reported.

Until the introduction of the microcomputer, hardware costs were the major deterent to CI use in public schools. Now major problems with software quality and instructional methods continue to retard the growth of CI (Molnar, 1976). The effectiveness of CI will be determined by the planning and direction given for its incorporation into the public school curriculum. Agricultural education needs a "...coherent, rational policy towards the use of computers for improved learning in our society. Well-planned policy is an essential component in assuring that optimal advantage is taken of this powerful resource" (Roblyer, 1980, p. 165).

Role of CI in Agricultural Education

Taylor (1980) identified three modes for applications of computers (hardware) in education: tutor, tool, and tutee. The tutor mode computer presents subject matter, and the student responds. The computer then evaluates the response and selects the next item for presentation based upon the response. Typically, informational and reinforcement programs are for use in the tutor mode. Whole courses or curricula may be presented using the tutor mode. The Los Nietos School of Los Angeles has tutor courses in basic math, reading, and writing skills for all elementary students (Hallworth and Brebner, 1980). The computer as a tool works as an instructional aid. Computer programs work as one part of the total teaching unit along with other instructional methods. The tool mode includes integrating programs and experiential programs. The third mode, the computer as tutee, involves students in teaching computers. The student doing the tutoring must learn to program or talk to the computer in a language which it understands. There are several benefits. First, the student must know the subject in order to teach it. Second, by trying to incorporate broad educational goals into the narrower capabilities of computer logic, the student gains a better understanding of how a computer works as well as how his or her own thinking process works. The third benefit of the tutee mode is that it does not require software; students create the software. Examples of the tutee mode are Papert's LOGO project at MIT and Dwyer's SOLO mode programming (Taylor, 1980).

In identifying the role of computerized instruction for vocational agriculture, one must consider three major factors. These factors are: (1) the available hardware, (2) the software currently available, and (3) appropriate methods for incorporating computers into present vocational agriculture curriculum. Consideration of the three educational computer modes in relation to these three factors causes the author to believe the primary role of computerized instruction should be as a teaching tool (tool mode) for secondary vocational agriculture education programs.

Presently, most public schools employ less than five microcomputers for all of its computerized instruction needs (Chambers and Bork, 1980). Microcomputers do not possess abilities for administration of comprehensive tutor programs. Effective classroom use of tutor and tutee computer modes requires one computer for each student in a class. Computers as instructional tools can be used with small groups or for an entire class at one time (Hallworth and Brebner, 1980).

Software available for vocational agriculture is oriented toward use in agriculture industry. Most of these programs are tools for record keeping or management decision making (Gille, 1982). Very little quality tutor software is applicable to vocational agriculture. Use of agricultural industry oriented software increases student computer literacy and their ability to use similar programs once they become employed. Software that capitalizes upon the computer's unique capabilities is ideal for classroom application. Computer tools reduce computational time needed for problem solving. Thus, students are able to focus upon subject problems rather than being bogged down in math computations (Thomas, 1982). In agriculture, some record keeping programs will automatically compute efficiency factors based on production data. Class discussion can be centered on means of increasing efficiency rather than the math needed to derive such factors. Decreased computations allow students to change input variables and explore cause and effect relationships in agricultural production systems. Management decision-making programs are often based upon system models using advance math beyond average high school level abilities. Since the computer completes the needed computations, students can concentrate upon the concepts used in building the models.

For computerized instruction to be successful in vocational agriculture, it must be useable with the current curriculum and strucuture of vocational agriculture programs. Instructional tools can be used much like other forms of teaching aids. Teachers are accustomed to using overhead transparencies, 16 mm films, slide sets, worksheets, and other types of instructional aids in their lesson plans. Tool mode computer programs could be incorporated as one of several possible student activities, especially when they are used with small groups or the whole class for decision making.

If microcomputers are available for individual student use, all three computer modes could be used to some degree. Students could keep their supervised occupational experience records on microcomputers or investigate special interest areas using advanced simulations. Advanced students could tutor the computer to produce tutor type programs based upon their previous vocational agriculture instruction. Students needing remedial work would then use the tutor programs to improve their knowledge and skills.

Implementation of computerized instruction faces problems in the areas of hardware systems, teacher training and attitudes, and software quality. These problems are not unique to agricultural education; all areas of education face similar problems. Solutions to hardware troubles will have to come from the computer industry. But, solutions for teacher and software problems should originate from within the educational community.

The present hardware systems using stand-alone microcomputers are designed to serve one user at a time. Industry is now working to develop time share systems for microcomputers (Thomas, 1982). One microcomputer could manage five time share terminals or any number of download terminals. Such systems would expand the computer capabilities and incorporate systems for managing tutorial mode instruction. Industry expects such systems to be on the market by 1985 (Hallworth and Brebner, 1980).

Teacher training must prepare teachers to use all forms of CI in their teaching and overcome prevalent negative attitudes. Among some teachers "...there is considerable awe of computers which is allied with fear and suspicion...they are perceived as threatening... and encroaching upon jobs as a preliminary to taking them over" (Hallworth and Brebner, 1980, p. 179). Computers without teachers are of little value. The instructor is vital to the success of any

CI system (Hallworth and Brebner, 1980). Using CI methods in preservice methods courses, and providing inservice demonstrations are two methods that have proven to be effective for helping teachers. Once teachers get involved in CI, they become enthusiastic (Loop and Christensen, 1980). Interest and enthusiasm are contagious. Horizontal spread of CI in schools is a common phenomenon. Once the attitude barrier is broken, teachers have little trouble designing methods for using CI in all areas of instruction (Jokels, 1980).

Lack of quality software is another deterrent to the incorporation of CI into schools, now and in the future. Only the tutee mode computer does not require software.

Software is not compatible between brands of hardware systems, and well-designed software is difficult to obtain. Software designed for an Apple computer will not work on a TRS 80 system and vice versa. Also, software used with mainframes will not work on a microcomputer. Only the MECC system of Minnesota has attempted large-scale efforts to convert software of other systems for use on Apple computers (Jokels, 1980).

Quality software suitable for educational uses is difficult to find and obtain. Without quality software "...microcomputers will be purchased by schools, and shortly, relegated to a cupboard most of the time" (Hallworth and Brebner, 1980, p. 115). Agriculture does have a few quality tool programs, but appropriate software for experiential, informational, reinforcement, and integrating instructional uses is rare. A variety of quality software is needed to improve CI in vocational agriculture. Quality software should meet standards in these areas:

1. Content - Content of the software must relate to the instructional curriculum of the agricultural program.
2. Cognitive development - The program builds upon previous student knowledge to guide the student in the formation of new knowledge.
3. Pedagogy - The process of learning must be enhanced by the interactive environment created by the program.
4. Technology - Software should be adaptable to meet the evolving capabilities of hardware.
5. Software design - The design should make use of the computer's complete capabilities whenever possible. The printed page fed into a computer is poor design (Olds, 1980).

These five standards give direction in developing software for instructional uses in vocational agriculture. But, the standards will be worthless without knowledgeable individuals such as teachers initiating the design of the software. Often, computer programmers do not understand educational processes well enough to formulate educational software.

Teacher training and software development are several years behind the hardware designs. Software forms the heart and brains of CI programs. Without the software, the computer is merely a glorified calculator, not worth its expense. Solving the problems named will be the next step for successful computerized instruction in vocational agriculture.

Summary

Computerized instruction should be included in secondary vocational agriculture programs to teach computer literacy, a needed skill in agricultural occupations, and to enhance student learning. In vocational agriculture, CI should be used as an instructional tool. This role was chosen because instructors have access to limited numbers of microcomputers, some appropriate software is currently available, and instructional tools can be incorporated into current teaching methods. Barriers to effective use of CI include lack of teacher training, insufficient instructional software, and small numbers of available microcomputers for instruction. If these problems are solved, future uses of CI in vocational agriculture should include use of the tutor and tutee computer modes.

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COMPUTERS IN AGRICULTURE --
A LOOK AT TODAY AND A PEEK AT TOMORROW

A Slide Presentation by Harlan Hughes

(Slide Set 1.0)

AGNET Coordinator
University of Wyoming
Laramie, Wyoming

Paper Presented at "Managing Farm Technology", Seminar, Saskatoon, Saskatchewan, February 2 and 3, 1982.

COMPUTERS IN AGRICULTURE -- A LOOK AT TODAY AND A PEEK AT TOMORROW

by

Harlan Hughes[1/]

INTRODUCTION

SLIDE 1 -- AGNET - A MANAGEMENT TOOL FOR AGRICULTURE

In the early 1970's, two professors at the University of Nebraska conceived the idea of an agricultural computer system designed specifically for farmers and ranchers. They developed the computer system now known across the country as AGNET--The Agricultural Computer Network. In 1977, the Governors of five states (Nebraska, South Dakota, North Dakota, Montana, and Wyoming) jointly funded a pilot project to test if farmers and ranchers in their respective states would use a computer system to make better management decisions. AGNET has now developed to where there are over 400,000 calls a year being made to the AGNET computer.

Wyoming now has computer terminals in all 23 county extension offices and county extension agents are now receiving training on how to use these terminals with their farmer and rancher clientele.

SLIDE 2 -- OPERATOR AT AGNET'S CONTROL COUNCIL

AGNET is one of three computers in this computer center. This operator controls the AGNET computer from the central council in this picture. If we have done our job right, the operator should not have to do much. Due to the speed of the machine, we prefer that the machine do as much of its own operation as possible. This operator, however, can and does take over control of the machine whenever necessary.

SLIDE 3 -- AGNET'S MASS STORAGE CAPABILITY

AGNET is a mass storage system. Behind the dark windows are stacks of phonographic records used for storage of data and programs. We have all of AGNET's programs stored on these disks so that when you type in the name of a program, the computer can immediately go to the appropriate disk and find the requested program. We do not have to wait for an operator to mount a tape or to do any manual intervention. AGNET is one of the largest mass storage systems in the world.

SLIDE 4 -- THREE PEOPLE STANDING IN THE COMPUTER CENTER

The gentleman with the sport coat is a very special person to AGNET. He is a farmer--and he is also on the AGNET payroll. George is a real character and I sure wish I could have brought him here for each of you to meet. George's role is to help make sure that what we have on AGNET will work for farmers and ranchers. I have heard George say, "Harlan, that is the dumbest #%&"* thing I have ever heard!" Or I have heard George say, "That may be well and fine in your ivory tower, but out on the farm we do not have that kind of data." We have two half-time farmers on the AGNET payroll and they play a very important and unique role in the design and operation of the total AGNET system.

SLIDE 5 -- THE COMMUNICATIONS EQUIPMENT

AGNET is set up so that we can have over 200 telephone calls coming in to the computer at one time. We are now averaging a phone call into AGNET every four minutes, seven days a week, 24 hours a day. That is over 400,000 phone calls a year.

SLIDE 6 -- NEBRASKA'S STATE CAPITAL BUILDING

The AGNET computer is located in the basement of the Nebraska State Capital. AGNET is not on a University campus computer by design and probably never will be on a campus computer due to our computer needs and demands. A University computer is set up for research and administrative data processing. We need a service oriented computer center that can consult us before the system is changed or shut down. Our users are not computer

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[1/] Harlan Hughes is AGNET Coordinator, College of Agriculture, University of Wyoming, Laramie, Wyoming.

science PhD's and will become frustrated with computer down time or off time. AGNET is often our user's first contact with a computer and since they are paying for the computer time, we place some stringent demands on the computer center.

SLIDE 7 -- MAP OF FULL PARTNER STATES

In 1977, five states became full partners in the AGNET system. The best way to describe a full partner state is to say that each state has a member on the AGNET Board of Directors.

In July of 1980, the state of Washington joined as a full partner state and in October, 1980, the state of Wisconsin joined AGNET. In July of 1981, Wisconsin withdrew, leaving six full partner states currently in the AGNET system. There are currently other states considering partner status, but nothing firm at this time.

SLIDE 8 — AGNET STAFF AT A TABLE

The concept behind AGNET is to share the development and operating costs among the full partner states. There are approximately 17 people on the AGNET payroll. Out of this seventeen people, Wyoming is paying for two. In a small state like Wyoming, we could not afford a large payroll, but we can afford to share the salary of the 17 people with six other states. Each state pools its resources with the other states so that each state can take advantage of the total efforts of the total 17 people.

I have a goal in life and it is to dissolve state boundaries--when it comes to information. Nebraska has some information that can be used in Wyoming and I believe that Wyoming has some information of use to Nebraska. We are proving that you can share information and computer programs across state lines. Each state does not have to spend resources to reinvent the wheel. In fact, I assure you that Wyoming does not have the resources to reinvent the wheel! We need to share extension resources with other states. The real winners of this sharing are our clientele.

SLIDE 9 -- AGNET PROGRAM LIBRARY

The six partner states in the AGNET system have developed the world's largest agricultural and home economics computer program library in the world. Today there are over 200 programs available to AGNET users. With a library of this size, no one is expected to use or even know how to use all the programs.

Our goal is not to have users able to use all the programs in the library, but rather to have a large enough library so that every user can find at least one program of interest. This large smorgasbord of programs means that users should be able to find several programs of special interest. Appendix I provides a partial list of the programs available on AGNET. I have grouped the programs by subject matter grouping to facilitate user interests.

SLIDES 9A THROUGH 9H -- PROBLEM SOLVING APPLICATIONS ON AGNET

The AGNET library has been put together with approximately 35 man years of programming effort. In addition, each program development is supervised by a subject matter extension specialist that is responsible for the subject matter content of the program. The program is owned by the subject matter specialist and not by AGNET. AGNET owns no subject matter programs.

AGNET is exceptionally well equipped for the livestock producer. There are livestock ration formulation programs available for range cattle, feedlot cattle, hogs, sheep, and poultry. There are programs available that will let you simulate on paper what your cattle will do in the feedlot given a description of your cattle and the ration that you are going to feed them. There are livestock budgets and planning prices stored in selected programs.

AGNET also has programs for the crop farmer. Machinery cost calculators and crop budgets are available. In addition, there are whole farm or ranch budgeting programs designed to help you make long-run business investment decisions. There are many, many more programs designed to help you make better management decisions.

Let's now look at some of the hardware that is being used to access the AGNET library.

SLIDE 10 -- TOUCH TONE TELEPHONE

The first computer terminal that I installed in a county extension office in 1972 was a touch tone telephone. It cost us $14 per month. We used the number-pad to send information to the computer and the computer sent back the information over the special loud speaker attached to the phone. We would send in the input numbers by typing them into the telephone. The computer would talk back and say, "Answer number 1 is 420." We print the answer onto a preprinted form which explained the interpretation of the number. This touch tone terminal served us very well as a low cost computer terminal. Industry still uses this type of small, low cost terminal.

SLIDE 11 - EXECUPORT TERMINAL

It soon became evident that we would like to have terminals in our county extension offices that would print out the computer information. We now have five of these Execuports in the Wyoming AGNET inventory. These cost us $1,400 for reconditioned terminals.

SLIDE 12 -- TEXAS INSTRUMENT 745 TERMINAL

We have installed these small portable TI-745's in most of our extension offices. They weigh approximately 13 pounds and can easily be moved around.

SLIDE 13 -- TI-745 WITH LID AND HANDLE

The TI-745 has a lid that clamps on and has a handle on it. It is the size of a small briefcase and weighs about half as much as my briefcase. Wyoming agents transport their terminals all over their counties. The TI-745 costs approximately $1,400 new.

SLIDE 14 -- NORTH DAKOTA'S CRT TERMINAL

Terminals come in all sizes and shapes. This is a terminal used by the Animal Science Department at North Dakota. Note that it has a TV screen where one can read the data. It also has a printer that can be used to generate a printed copy of the output when desired. These dual purpose units cost more money, but the flexibility is convenient and does reduce paper costs.

SLIDE 15 -- ALBERTA AGRICULTURE'S TERMINAL

This is a decwriter terminal that the Department of Agriculture in Alberta, Canada, uses. I was there one time and needed to check my electronic mail so I used their terminal. Alberta Agriculture subscribes to the AGNET system. This terminal costs around $2,000.

SLIDE 16 -- MY SECRETARY WITH TELETYPE 43 TERMINAL

This is my secretary with her Teletype 43 terminal. This is the terminal that is also on my desk so you can see that this is the terminal that I like best. These TT-43's get used more hours than any of our terminals and it is virtually a maintenance-free terminal. The only problem is that they are not portable. They weigh 45 pounds and you have the terminal plus the telephone coupler to move. In addition, the paper has to also be moved making a total of three things that you have to move. This terminal also costs approximately $1,400.

SLIDE 17 -- ADDS TERMINAL WITH TV SCREENS

We have one special terminal that drives 23-inch TV screens for demonstration and teaching purposes. These are the same TV screens that you see in airports with flight schedules. We use these screens so that clientele and students can see exactly what we type on the terminal and exactly what the computer sends back to the screens. These screens have done a lot to help promote AGNET in Wyoming. The screens work so well that I will not give a demonstration without these screens. The special terminal and the two screens cost approximately $4,000; therefore, we have only the one in Wyoming.

SLIDE 18 -- FIRST NATIONAL BANK'S TERMINAL

This is a special terminal that has a TV screen and the printer all in one unit. I found this terminal in the First National Bank in Fort Collins, Colorado. This terminal costs around $7,000 so you find't find one of these in public offices. It is a nice terminal but before you spend $7,000 for a terminal like this, there is a whole new technology that

I would like to show you. This technology is the microcomputer that you are reading and hearing so much about.

SLIDE 19 -- RADIO SHACK CHRISTMAS ADVERTISEMENT

In late fall, 1977, Radio Shack started advertising the TSR-80 microcomputer for Christmas. This started making the general public aware of the personal microcomputer.

SLIDE 20 -- ATARI MICROCOMPUTER HOOKED TO A COMMON TV

This is an Atari computer that is hooked up to a regular TV. This is a stand-alone computer. Atari's have historically been a game computer and, to my knowledge, there are no agricultural programs available for the Atari microcomputer.

SLIDE 21 -- TI-99/4 MICROCOMPUTER

Texas Instruments came out with its 99/4 microcomputers. Texas A & M arranged to work with TI to test the 99/4 in agricultural applications. After several months of research, it was decided that the 99/4 was not suited to agricultural applications. TI has now designed the 99/4A, but I am not familiar with anyone looking seriously at the 99/4A for agricultural applications.

SLIDE 22 -- RADIO SHACK MODEL I

The Animal Science Division at the University of Wyoming has a Model I Radio Shack microcomputer. As is typical of most microcomputers, it has a keyboard, a TV screen, a disk unit, and a printer.

SLIDE 23 -- DR. SCHOONOVER AND RANCHER

Dr. Schoonover from Wyoming has developed a Herd Performance program for the Radio Shack Model I and III microcomputers. This program keeps track of the cow/calf information that ranches have been keeping on 3- x 5-inch cards. Once the data is inside the computer, management reports can be quickly printed out helping the rancher determine the cows to keep and the cows to cull.

SLIDE 24 -- BHPP & BHAP

The same herd performance program that Dr. Schoonover has on the Radio Shack microcomputer is also on the AGNET system. We have several Wyoming ranchers currently using these herd performance programs.

SLIDE 25 -- RADIO SHACK MODEL II

This is a picture of the Radio Shack Model II. Note that the disk drive is built into the unit on the right. Radio Shack refers to this as their small business machine.

SLIDE 26 -- RADIO SHACK MODEL III

This is the Radio Shack Model III. Notice that it has two disk drives built into the unit. I have this slide in here to illustrate that you can use microcomputers to present pictures and graphs of your data. Graphics capabilities are excellent on microcomputers.

SLIDE 27 -- 2ND RADIO SHACK MODEL III

This slide is in here as another illustration of how microcomputers can be used to present pictures of data. This could just as well be a bar graph of ranch profits for the last five years. It has been suggested by ranchers in previous presentations that the graph is backwards if it represents ranch profits. Profits have been decreasing rather than increasing. My response is that this represents what will happen if a rancher purchases a small business computer!

SLIDE 28 -- AFFORDABLE SMALL BUSINESS MACHINES

While many people like to refer to microcomputers as hobbiest machines, personal computers, etc., I will only refer to microcomputers as "small business computers." I am serious about their use on farms and ranches as small business machines.

SLIDE 29 — BOOK SHELF IN A COMPUTER STORE

Most computer stores have several books and magazines available on microcomputers and how to use and program them. I strongly encourage farmers and ranchers thinking seriously about purchasing a computer to get one or two magazines or books on microcomputers. Farmers and ranchers read several agricultural related magazines, so why not read at least one computer related magazine.

I personally subscribe to BYTE. It is a good magazine to read to find out what kind of hardware is available. By spending a couple of hours in your easy chair reading a computer magazine, you will start to learn the jargon of computers. It will help out considerably when you walk into a computer store.

I also subscribe to the Personal Computing magazine. It has stories written by people who are familiar with microcomputers for people like you and I who are not familiar with microcomputers. A few magazines will prove to be well worth the time and dollars to learn about this new farm and ranch management tool.

SLIDE 30 -- AGNET'S APPLE COMPUTER

This is Wyoming's Apple computer. Since this picture was taken, we have added a second disk drive. Also, note that we have one of our Teletype 43 AGNET terminals as a slave terminal to the Apple. With proper connections, you can use your existing terminal as a slave printer on your microcomputer.

SLIDE 31 — DR. MENKHAUS AND HIS APPLE COMPUTER

We are starting to teach undergraduate students how to use microcomputers. This slide shows Dr. Menkhaus using his Apple microcomputer in his Price Analysis class at the University of Wyoming.

SLIDE 32 — APPLE HOOKED TO BLACK AND WHITE TV

They are trying to make it so that you can use as many common household appliances as possible with microcomputers. If you have a black and white TV you can hook it up as the CRT on the Apple (and other brands, also). The resolution is not quite as clear as a regular monitor, but it is a cheaper way to get set up with a microcomputer.

SLIDE 33 — APPLE III

The newest Apple is the Apple III. It has been out for about a year, but has had some technical troubles that has set its acceptance back. The Apple company has recalled them several times. The general public has lost some confidence in the Apple III. The Animal Science Division at Wyoming cancelled its order for the Apple III and ordered the Apple II Plus. It appears that a fast growing company having excellent sales, moved into a new product and forgot something called "quality control." It has hurt the sales of the Apple III.

SLIDE 34 — COMPUTER CONCEPTS STORE FRONT IN CHEYENNE, WYOMING

Another popular microcomputer is the Pet Commodore. The Division of Ag Economics at Wyoming at a Pet.

SLIDE 35 -- PET COMMODORE MICROCOMPUTER

This is a picture of the Pet Commodore microcomputer owned by the Divison of Ag Economics.

SLIDE 36 — ALBERTA AGRICULTURE PET

This is another picture of a Pet Commodore that is being used by Alberta Agriculture in Canada. They have written a fair amount of agricultural software for the Pet. Fortunately, they have been willing to share that with Wyoming so we do have several decision aids for our Pet Commodore.

SLIDE 37 — PET WITH WORD PROCESSOR ON SCREEN

This slide is in here to remind me to comment on how micros can be used for word processing. You can buy word processing programs for almost all micros that will let you use your micro to generate printed materials like letters and reports.

Word processing allows you to electronically add words, delete words, add paragraphs, move paragraphs, etc. When you have your paper like you want it, you can print out the letter or paper on the computer's printer. I now write all my papers on the word processor.

While word processing will not be a big thing for many farmers or ranchers, it might be of value to those of you that are officers of farm organizations. I sure can see how Dave Flintner, President of Wyoming Farm Bureau, could use word processing in his Farm Bureau business.

SLIDE 38 -- LEVEL I HARDWARE

There are two levels of microcomputers being considered by farmers. For the lack of any other terminology, I will use "level I and level II' as the classifications. Level I micros are the lowest cost and most popular systems. The three most common level I micros in agriculture are the ones we just looked at--Radio Shack, Apple, and Pet Commodore.

Let's now take a look at some of the level II microcomputers that farmers and ranchers are considering.

SLIDE 39 — NORTHSTAR MICROCOMPUTER

One level II microcomputer that is fairly popular is the Northstar. While you don't see much of the computer here, my goal here is to get you familiar with the different brands. Country Side Data out of Utah is selling agricultural software for the Northstar computer.

SLIDE 40 -- COMPUTER STORE IN FORT COLLINS

Different computer stores handle different kinds of microcomputers. Here is a store in Fort Collins that handles level II microcomputers.

SLIDE 41 -- VECTOR GRAPHICS MICROCOMPUTER

This is another level II microcomputer called the Vector Graphics. Notice that the disk drive is below the printer. Holmstead Computers out of Canada has several software packages for the Vector. In addition, Loren Bennett out of California has a dairy ration package for the Vector.

A second thing that I want you to notice in this picture is the printer. I call this a "professional" printer. This is the kind of a printer that is used for word processing. If we had a letter typed with this printer, I could convince you that the letter was typed by my secretary on her IBM electric typewriter. Professional printers sell for around $3,000; however, if you are going to do word processing, a professional printer is preferred.

One purebred cattleman has a professional printer on his micro. He uses the word processor to write individual letters to his purebred cattle customers. He keeps a list of potential customers inside his computer. When he has a bull for sale, he then uses the word processor to generate and address personal letters to each customer. Each customer thinks the cattleman personally types the letter to them. In reality, his microcomputer merged the names into the standard letter stored in the micro. This cattleman argues that this is a very cost effective way to advertise his purebred cattle. The key is the professional printer and the word processing software.

SLIDE 42 -- SUPERBRAIN MICROCOMPUTER

This is a picture of a Superbrain that South Dakota AGNET has. It is a level II microcomputer. Notice that the disk drives are built into the cabinet. This is extremely nice when you move the microcomputer around.

SLIDE 43 -- HULLETT PACKARD 85

This is the Hewlett Packard 85. Since this picture was taken, HP announced the HP-125 as their small business machine. HP long has a reputation of producing high quality products and we believe this is also true for their microcomputers. To date, I am not aware of any agricultural software available for the HP machines.

SLIDES 44 & 45 — INSIDES OF A CROMENCO COMPUTER

This is a picture of the insides of a Cromenco microcomputer. Notice the cage (called S-100 buss) and how the board slide into the cage. Notice also that there is room for several additional boards to meet your expanding needs. This micro is configured to be a fairly powerful microcomputer, yet there are several empty slots for future additions. Level II machines are considerably more flexible than the level I machines. This common S-100 buss allows board manufacturers to build one board that will fit several different kinds of machine. This is a real advantage to having a S-100 buss microcomputer.

SLIDE 46 -- LEVEL II HARDWARE

The more common level II microcomputer that farmers are considering are: Northstar, Vector Graphics, Superbrain, Hewlett Packard, and Cromenco. There are also other brands but they tend to be less popular.

SLIDE 47 — CHARACTERISTICS OF LEVEL II MICROCOMPUTERS

There are several differences in the level II micros as compared to the level I micros. The key differences are: basic language compilers that are faster than level I interpreters, 80 character screens which make visicalc and communications easier to use, more standard operating systems such as CP/M (this means it is easier to exchange programs from one machine to another), more error diagnostics for software and hardware, and the S-100 buss (for more hardware exchangeability).

SLIDE 48 -- DATA CASSETTE

In the past, we used cassettes for data and program storage. In fact, you can use your kids' cassettes and their tape recorder on your micro to record data and programs. While this is a very cheap storage device, by today's standards it is too slow and inflexible.

SLIDE 49 — FLOPPY DISK

The technology that has made microcomputers of value to agriculture is the floppy disk--a phonograph record with a paper covering around it. Instead of recording music on the disk, the micro records data and computer instructions on the disk. The floppy disk now provides the microcomputer with mass storage capability. Dr. Schoonover can store data for 500 cows on one of these disks. If you have 1,000 cows, you simply use two disks. In fact, you can have as many of these disks as you want on the shelf. You just pull off the shelf the disk that you want and put it into your micro.

SLIDE 50 -- HARD DISK FOR MICROCOMPUTER

The newest storage technology is the hard disk (pictured on the left). Inside this little box is the ability to store 5 million characters of data. You could store all the management information that you would ever need or generate on your farm or ranch on this one hard disk. Most farmers or ranchers do not have this kind of data storage needs. The purebred cattleman that I have mentioned before has a hard disk on his Vector Graphics machine. He keeps all his pedigree information for his cow herd on the hard disk. In fact, he can go back to 1932 with his pedigree searches. He feels that the microcomputer has helped his purebred business out considerably.

SLIDE 51 — TEACHING CENTER

This is a Radio Shack Teaching Center. It has 15 microcomputers hooked up to a sixteenth computer. The sixteenth computer can monitor the other 15 computers. Wyoming's agricultural Extension service needs one of these to bring 15 ranchers or farmers in for training. I sure wish that I could take 15 of you and set you down to a training center like this! I am sure that I could help you learn more about microcomputers than my just showing you slides. While you may say that having these kinds of teaching centers is wishful thinking, did you know that many high schools and vocational technical schools have similar setups? It's university extension services that are behind.

SLIDE 52 — COMPUTERS FOR FARM AND RANCH

Let's now boil this all down—what does it mean for you on the farm or ranch.

SLIDE 53 — MEETING THE CHALLENGES OF THE 80'S

Agriculture is going to have some serious challenges in the 80's. While during the 60's and 70's your challenge was production, the challenge in the 80's is going to be financial management. The fact that you are at this conference tells me that you recognize this and that you are looking for ways to improve your financial management.

Yes, the computer does offer some potential for some of you. Let me make a prediction. Those of you that will be farming in 1990 will be using computers. Those of you that do not want to use a computer will not be farming in 1990. Many farmers and ranchers do not want to use computers. I often hear, "No damn computer is going to tell me how to farm!" I predict that person won't be farming in 1990. Many will have retired and others will have gone out of business. Computers are going to become commonplace on U.S. farms and ranches during the 80's.

SLIDE 54 — PRODUCER OWNED COMPUTERS

As I travel around the country talking to farmers and ranchers, I hear them expressing interest in three applications of the microcomputer. The three applications are:

1. Business Accounting
2. Herd performance reporting
3. Financial management.

Top producers are recognizing that they need to keep better books. They are looking to the microcomputer as a means to making bookkeeping easier and more flexible. They want current cashflow situations several times during the year. Today's profit margins do not allow the management errors that you could get by with in the 70's.

Top ranchers know the benefits of good cow-calf records and they have been keeping them on the 3- by 5-inch cards; however, it takes a lot of time to sort them into useful management reports. A herd performance system fits well onto a microcomputer and once the data is in the computer, management reports can easily be printed out. We even know of one rancher that takes his micro right out to the scales and enters the calf weights as they are weighed. When the last calf is weighed, he pushes the button and identifies the cows to be immediately culled. He says this saves considerable time by not having to round up the cows again when he has the culling data available. He argues that the cost savings of rounding up cattle the second time will pay for his microcomputer.

Bankers are requiring more and more financial information before they will make loans to producers. Top producers are starting to see the potential of being able to use the microcomputer to help generate these needed reports. Financial Statement, Profit and Loss Statements, cash flow projections, five-year plans, etc., can all be generated with the aid of a microcomputer.

SLIDE 55 — VISICALC - A FINANCIAL MANAGEMENT TOOL

One of the most powerful financial management tools available is VISICALC. It is designed so that you don't have to be a programmer to program your own financial management programs. There is nothing equivalent on AGNET! Since I don't know how to describe in words what VISICALC can do, we will just have to demonstrate it to you during the demonstration period. If you don't see our demonstration, stop into a computer store and ask for a VISICALC demonstration.

SLIDE 56 -- DISK ORIENTED SYSTEM

In order to have sufficient capacity to handle your agricultural applications, producers should buy a disk-oriented system. It should contain:

1. dual disk drives
2. a good 80-column printer
3. 32K to 48K memory (the horsepower of the computer)
4. 80-column screen (preferred over a 40-column screen)
5. telephone coupler

The system will cost between $4,000 to $5,000 for the hardware and I would expect that you will spend $2,000 to $3,000 for programs (software) for your farm or ranch.

SLIDE 57 -- TELEPHONE COUPLER

One of the extremely useful attachments that you can purchase for your microcomputer is a telephone coupler. This will allow you to use your micro as a terminal to large mainframe computers such as AGNET, TELPLAN and CMN. You can call the mainframe on the telephone and type in your information on your micro's keyboard and have the output printed out on your micro's printer. The cost of a phone coupler is around $300.

SLIDE 58 -- APPLE TELEPHONE COUPLER

The black box in the lower left hand corner is a picture of one kind of telephone coupler for an Apple computer. Notice that one of the cords is plugged directly into the telephone outlet box. The other cord is plugged into a board in the Apple computer. With this black box, you can then call other computers--even other Apple computers. You can use this to call your university computer, AGNET, the DHIA computer, and your local cooperative's computer. A telephone coupler opens up all kinds of opportunities for you to access agricultural information. A telephone coupler is a must for any producer-owned system.

SLIDE 59 — INFORMATION NETWORKING ON AGNET

For example, if you have a telephone coupler on your micro you can access:

1. current commodity market prices.
2. current USDA, Foreign Ag and Wyoming news releases.
3. Agricultural outlook and situation reports.
4. Western Livestock Market Information Project livestock analyses.
5. Hay for sale.
6. Sheep for sale.
7. Certified pesticide applicators in Wyoming.
8. People interested in judging county and state fairs.
9. Horticultural tips during the summer.
10. Home canning tips during the canning season.
11. Emergency information such as drought tips, Mount St. Helen's emergencies, etc.

You can even use your micro to access the UPI and AP news services available. Wouldn't it have been interesting to have been able to search for any news stories dealing with the "Farm Bill" during recent months? Or search for the news stories about "beef." The AP and UPI news services are available from two commercial time-share companies. You can do all this today with your micro if it has a telephone coupler on it.

SLIDE 60 -- MARKET INFORMATION ON AGNET

We are putting around 17 different daily market price files on AGNET, including the futures opening and closing prices. We have Chicago, Kansas City and Minneapolis futures going onto AGNET. In addition, we have both national and selected local cash markets going onto AGNET. We are reporting local feeder cattle sales in Wyoming, Northeastern Colorado, and Western Nebraska. Local grain and cattle markets are being put on weekly for Nebraska. Feedlot reports for the major cattle feeding states are going periodically. Export data is also going on weekly. AGNET is becoming a major source of market information for agricultural producers. This appears to be the major reason for most of our producer subscriptions to AGNET. They want current market information.

SLIDE 61 -- HOW TO BUY A SMALL COMPUTER

What should a farmer and rancher do if he is thinking about buying a small computer?

SLIDE 62 -- FARM COMPUTER NEWSLETTERS

There are two newsletters that I recommend that you subscribe to on computers in agriculture. Successful Farming is now publishing the newsletter shown in this slide. I believe the subscription rate is $40.00 per year. They evaluate hardware and agricultural software and I find these evaluations very useful.

The second newsletter is published by Doane-Western Agricultural Service out of St. Louis, Missouri. Their subscription rate is $48.00 per year. Both of these newsletters are excellent sources of information about microcomputers. If you are seriously considering a microcomputer, I strongly recommend that you subscribe to one or both of these newsletters.

SLIDE 63 -- HOME COMPUTERS FOR FARM USE

The second thing I recommend that you do if you are considering purchasing a computer is attend one of the computer seminars that are being held around the country. Almost every state extension service is holding these seminars specifically for farmers and ranchers interested in learning more about microcomputers and the potential agricultural applications. Contact your local county extension agent or extension advisor for information on these seminars.

SLIDE 64 — SUMMARY

In Wyoming we are using the AGNET system to provide Wyoming farmers and ranchers with their first contact with computers for:

1. Record keeping such as beef herd performance.
2. Problem solving for computer aided decision making.
3. Information networking such as daily market information.
4. Electronic mail to speed up the delivery of research and extension information to clientele.

Computerized Management Aids (CMA's) are not new to agriculture. They are just new to the west. Leading Midwest farmers have been using CMA's for over 10 years.

Microcomputers are the new farm and ranch management tools and innovative producers are buying them. More and more farmers and ranchers are going to own one or more microcomputers.

If you buy a microcomputer, be sure and buy the telephone coupler so that you can access the agricultural information networks being set up across the country. You will need to spend around $4,000 to $5,000 for a microcomputer with enough horsepower and flexibility to do your farm or ranch applications. If you will only spend less, maybe a microcomputer is not for you. I do assure you, however, that we are going to see considerably more farm and ranch purchases in the next five years.

APPENDIX I

Listing of Programs Available to AGNET Subscribers

NOVEMBER 1981

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           AA     GGGG   N    N  EEEEEE   TTTTT
          A  A   G    G  NN   N  E          T
         A    A  G       N N  N  EEE        T
         AAAAAA  G   GG  N  N N  E          T
         A    A  G    G  N   NN  E          T
         A    A   GGGG   N    N  EEEEEE     T

PPPPP   RRRRR    0000    GGGG   RRRRR     AA     M    M   SSSS
P    P  R    R  0    0  G    G  R    R   A  A   MM  MM  S    S
PPPPP   RRRRR   0    0  G       RRRRR   A    A  M MM M    S
P       R  R    0    0  G   GG  R  R    AAAAAA  M    M      S
P       R   R   0    0  G    G  R   R   A    A  M    M  S    S
P       R    R   0000    GGGG   R    R  A    A  M    M   SSSS

                         IIIII  N    N
                           I    NN   N
                           I    N N  N
                           I    N  N N
                           I    N   NN
                         IIIII  N    N

        DDDD    EEEEEE  TTTTT     AA    IIIII   L
        D   D   E         T      A  A     I     L
        D    D  EEE       T     A    A    I     L
        D    D  E         T     AAAAAA    I     L
        D   D   E         T     A    A    I     L
        DDDD    EEEEEE    T     A    A  IIIII   LLLLLL
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TABLE 1: SELECTED LIVESTOCK PRODUCTION MODELS ON AGNET

MODEL NAME	DESCRIPTION OF MODEL
BEEF GROWER	Grows beef cattle from an initial weight to some final weight given environmental temperatures, feedlot conditions and ration specifications. Frame size, nutritional background, sex and compensatory growth are all taken into account.
BEEF FEEDER	Predicts the performance of specific feedlot cattle under different environmental temperatures.
FEEDMIX	Designed to formulate "Least-Cost Balanced Rations." Major objective is to find what combination of your feed will meet the animal's nutrient requirements at the lowest cost. You can also use "Ration Check" to analyze your existing ration. BEEF - primarily for feedlot operations RANGE - primarily for beef cows and calf wintering operations DAIRY - for dairy rations SWINE - for swine rations POULTRY - for poultry operations
SWINE FEEDER	Predicts how the performance of swine at a given weight (lbs) is affected by environmental temperature.
SWINE GROWER	Will grow swine from an initial weight to some final weight given environmental temperatures.
COWGAME	Simulates the selection process in beef herds. Demonstrates the genetic principles which affect the rate and amount of response to certain common selection factors in beef cattle. You are given an initial herd of 50 cows and you have to make mating decisions based on performance information provided. Teaches how to use beef performance programs in selecting cattle.
BHPP/BHAP	Beef Herd Performance Program and Beef Herd Analysis Program. Used to generate, store, and analyze individual ranchers' beef herds. Designed for commercial cow herds rather than purebred operations.
WEAN/YEARLING	Beef herd performance programs for purebred operations.
RANGERATION	Simple, fast and effective ration balancer for beef cows, wintering calves, horses, and sheep. Basically a computerized "Pearson Square".
VITAMINCHECK	Check vitamin and/or trace mineral additions to a swine diet. Compares what's in a given diet to the nutrient requirements of swine.

TABLE 2: SELECTED AG ENGINEERING MODELS ON AGNET

MODEL NAME	DESCRIPTION OF MODEL
TRACTORSELECT	Once a power level has been selected, this model helps a user determine the suitability of a specific tractor to his farming or ranching enterprise. Nebraska tractor test data is stored in the data base.
CONFINEMENT	Determines the ventilation requirements and heater size for a swine house given its usage, capacity, dimensions, R values, ventilation rates and the inside and outside design temperatures.
PUMP	Provides a suggested bill of materials needed to install an irrigation system. System components are identified along with suggested life and cost. Can compare several different irrigation systems with one another or can evaluate performance of an existing system.
HOUSE	Estimates the heat loss and costs of heating and cooling a house given location, inside design temperatures, dimensions and size and specifications of walls, doors, windows, roof, ceiling and foundation. Uses stored weather data bases.
BINDRY	Predicts the results of most natural air and low temperature corn drying systems with the drying occurring in the bin. Program uses actual weather data for selected locations.
DRY	Grain drying simulators for (1) crossflow, (2) concurrent, (3) counterflow, and (4) natural air type driers.
FANSIZE	Estimates fan size requirements (static pressure losses, total CFM and horsepower) to deliver air at prespecified airflow rate through a specified grain for a given duct bin system.
FANMATCH	Matches a fan's performance characteristics (as presented by advertised CFM vs S.P. rating) to a system (bin, duct, and grain type) and generates a table specifying the fan's performance at various grain depths.
DUCTLOCATION	Determines the number, size and location of aeration ducts to properly aerate grain in a flat storage building. Full round or flush mount ducts can be selected.
STOREGRAIN	Calculates the costs and break-even prices for on-farm vs. commercial grain storage for periods up to 36 months. The storage costs presented are broken down showing interest charges, shrinkage amounts, property taxes, etc. Up to 6 storage periods can be considered simultaneously.
GRAINDRILL	Calculates the lowest cost width for a grain drill for your farm. You can then check its ability to cover your acres on time and also check its power requirements against your tractor's capacity.

TABLE 3: SELECTED CROP PRODUCTION MODELS ON AGNET

MODEL NAME	DESCRIPTION OF MODEL
IRRIGATE	Aids in monitoring crop water use and in scheduling irrigations. Predicts crop water use for 12 days into the future and determines the next date to start the irrigation system. Uses two methods to predict water use: (1) min-max temperatures and soil moisture blocks or (2) min-max temperatures, wind run, solar radiation, and dew point temperature data.
HAYLIST	Allows hay producers to list hay supplies, pasture and/or stalks for sale. Program designed so that buyers can find out who in their community, county or region has these items for sale.
BESTCROP	Provides an equal return yield and price analysis between two or more cropping alternatives based on expected yield, price and direct cash expenses.
SOILSPROGRAMS	A series of 16 programs geared to Nebraska's teaching, research, and extension soils program. Programs vary from student review exams, performing multiple regressions on certain types of fertilizer experiments to providing fertilizer recommendations on the basis of user selected soil test data.
RANGECONDITIONS	Calculates the range condition and carrying capacity of native range. Retrieves information on the classification of various range plants stored in the data file. Present data base is for Western Nebraska.
SOIL LOSS	Estimates the computed soil-loss (tons/acre/year). Designed for cropland east of the Rocky Mountains.
FLEXCROP	Forecasts yields based on amount of water available for crop growth. Base yield is adjusted for variety selection, fertilizer application, weed control, rotation, and planting date. Current crops are wheat, barley, oats, and safflowers, data base geared to Montana.
SEEDLIST	Provides seed producers a way to list supplies of seeds for sale. Sellers can easily update the listings as part of the seed is sold and they can delete the listing when all seed stocks have been sold. Buyers can scan county by county for particular variety.

TABLE 4: SELECTED HOME ECONOMIC MODELS ON AGNET

MODEL NAME	DESCRIPTION OF MODEL
DIETCHECK	Performs a check on your nutritional intake for a specified time period compared to required daily allowances stored in the computer.
DIETSUMMARY	Provides a group summary analysis of the individual DIETCHECK runs made for a specific group of people.
FOODPRESERVE	Compares the costs of home canning of fruits and vegetables versus buying canned goods at the store.
BEEFBUY EXBEEFBUY	Analyzes: (1) the amount of packaged meat in a live steer, side or quarter of beef, (2) the cost of meat actually put in a freezer, and (3) the cost of various methods of purchasing beef. EXBEEFBUY runs a sample of BEEFBUY.
PATTERN	Helps a seamstress select a commercial pattern size and type most suited to her figure.
STAINS	Makes recommendations for stain removal methods given fabric type, stain, etc.
FIREWOOD	Analyzes the cost efficiency of heating with wood versus traditional heating fuels.
MONEYCHECK	Helps families look at their family financial budgets. Compares their specific budget to typical budgets for families of same characteristics.
BUSPAK	
LOAN	Calculates loan payments given loan amount, length of loan, interest rate and number of payments per year.
EQUITY	Calculates loan payments and prints out a repayment schedule for your specified loan.

TABLE 5: SELECTED 4-H AND YOUTH MODELS ON AGNET

MODEL NAME	DESCRIPTION OF MODEL
CIS	Designed to provide high school age youth with an opportunity to explore alternative career choices and to learn about the training required, where training can be obtained, what the potential salaries are, etc. Youth can quickly broaden their understanding of potential careers that match up to their interests.
SCORE	Provides computer assistance to record keeping and scoring of 4-H judging contests. Has been modified to fit Wyoming's Vo Ag and Community College judging contests. Allows judging coaches to retrieve detailed member analysis class by class. (Designed by Wyoming).
FAIR	Tabulates and scores judging contests. Tabulates placings, questions, reasons, and other classes that you want to set up. Output results for individuals or by division (juniors and seniors). Uses mark sense input. (Designed by Nebraska).
CARCASS	Used to analyze and tabulate beef or lamb carcass judging contests. The model calculates cutability, yield grade, and index from eight input items. Results can be ranked by any desired output column.
PREMIUM	Compiles and summarizes county fair premium data. You are able to enter a descriptive title for each lot and class. Program calculates premium amount for each contestant even if receiving premium money from several classes.
JUDGELIST	Lists people available to serve as judges for county fairs, by areas qualified. County may add names as well as list those already on file.
COWGAME	Simulates genetic selection in beef herd. Several teams may "compete" over time. See Table 1.

TABLE 6: SELECTED FARM AND RANCH PLANNING MODELS ON AGNET

MODEL NAME	DESCRIPTION OF MODEL
CALFWINTER EXCALFWINTER	Provides an estimate of production and marketing costs associated with wintering calves. Allows user to also include costs of additional capital investments needed to be able to winter calves. EXCALFWINTER runs a sample of CALFWINTER.
GRASSFAT	Provides an estimate of production and marketing costs associated with pasturing yearling calves during the summer. Costs of additional capital purchases needed are also taken into account.
COWCOST	Provides an estimate of production and marketing costs and returns associated with a beef cow-calf enterprise. Variable costs plus straight line depreciation on new and existing capital improvements are calculated and printed out.
EWECOST	Estimates production and marketing costs associated with a sheep enterprise. Variable costs plus straight line depreciation on new and existing capital improvements are calculated.
DAIRYCOST	Analyzes the monthly costs and returns associated with a dairy enterprise. Cost information is presented on a per-hundred-weight of milk produced. Home grown feeds produced on the farm are charged at the current market price.
LSBUDGETS	Designed to print out stored livestock budgets. Program allows quick input changes so user can easily customize the budget to a specific situation.
MACHINEPAK	A package of machinery related programs.
MACHINE	Used to estimate field machinery costs. Can be used to estimate custom rate, compare costs between machines or estimates a lease rate using fixed costs only. Can also be used to estimate costs of different field operations.
CUSTOM	Uses results from "MACHINE" program to calculate: (1) breakeven acreage for purchasing a machine and (2) calculates a custom rate to charge for field work performed.
GRAINDRILL	Calculates the least cost width for a grain drill for your farm. Allows you to check the drill's ability to cover your acres on time and to check power requirements against your tractor's capacity.
FIXEDCOST	Estimates fixed costs as a percent of purchase price for farm machinery and equipment. Resulting percentages can then be entered into the "MACHINE" program.
SEMITRUCK	Estimates the current costs of operating a tractor-trailer rig. Both variable and fixed costs are considered in the model.

TABLE 6: SELECTED FARM AND RANCH PLANNING MODELS ON AGNET (continued)

MODEL NAME	DESCRIPTION OF MODEL
LANDPAK BUYLAND	Package of programs to assist in land management decisions. Estimates the maximum bid price per acre that you can afford to bid for land. Takes land appreciation and tax benefits into account. Projects your cash flow requirements if you pay the maximum bid price.
CASHRENT	Calculates what you can afford to pay for rent given your production costs and economic outlook.
MINCOME	Calculates the minimum net cash income required to pay the loan payments and income taxes per acre of land purchased. User enters his land bid price and the program determines the net cash income needed per acre to pay for it.
BUSPAK	A package of financial analysis programs made available by the Business School. Many apply also to agriculture. For example: depreciation, loan, and equity.
DEP	Calculates depreciation for any specified asset. You pick the depreciation method.
DEP3	Calculates the annual depreciation charges for a new or used piece of equipment. Lets you compare three methods of depreciation for new assets and two methods for used assets.
LOAN	Calculates the payments required to meet the specifications of a loan. You can solve for different unknowns by providing the other numbers.
EQUITY	Prints out a repayment schedule for a user specified loan.
PLANPAK	A package of 7 programs designed to help farmers and ranchers analyze and plan the financial and production aspects of their farm or ranch business.
FARMPLAN	Provides a computerized budgeting procedure for comparing the physical and financial characteristics of your present farm or ranch organization with alternative farm and ranch organizations. It permits the user to size up future profitability, debt servicing ability, and solvency characteristics of your present farm or ranching operation.
PLANTAX	Calculates your potential Federal income taxes based on the information you enter on current income and expenses. You can easily consider the tax outcomes of alternative tax management strategies to minimize your Federal Income Tax payments.

TABLE 6: SELECTED FARM AND RANCH PLANNING MODELS ON AGNET (continued)

MODEL NAME	DESCRIPTION OF MODEL
CROPBUDGET	Calculates and prints out crop budgets. Analyzes the operational cost of the machinery inputted and any custom operations the user uses in producing the crop. Program outputs a list of the operations done to produce the crop.
CROPBUD	Prints out selected Wyoming crop budgets published by the Ag. Economics Division. Internal data files serve as the starting point. Users are allowed to change input items to their specific circumstances so output can be customized to their specific situation.

TABLE 7: SELECTED INFORMATION NETWORKING MODELS ON AGNET

MODEL NAME	DESCRIPTION OF MODEL
MARKETS	Disseminates weekly and daily commodity prices to all AGNET users. Selected files are updated with futures markets put on twice a day. There are 18-20 different market files being maintained on AGNET.
NEWSRELEASE	Designed for rapid dissemination of newsworthy information dealing with the broad scope of agriculture and home economics information. Information items are divided into categories such as consumer, foods, crops, energy, safety, situation and outlook, management, youth, other.
GUIDES	Similar to NEWSRELEASE but files are of more long-term interest, such as drought, horticulture, and other tips.
HAYLIST	Designed to identify and locate who has hay for sale, pasture to rent, or stalks for sale. Seller can categorize his feed for sale or rent by type, harvesting method, county, and city. Sellers can add in specific comments to better describe their products for sale.
EWESALE	Designed to identify and locate usable sheep for sale. Allows seller to add his specific comments including price (optional) to categorize his sheep.
MAILBOX	Used to send and receive messages and electronic mail to/from other AGNET users. Selected mailing lists are already stored in the computer so the user has to type the message only once and the computer will automatically duplicate it for all addresses in the mailing list. A "Hotline" mailing list is available for regional or national emergencies.
NEWS	Provides AGNET users with latest AGNET system notifications about programs and user related information.
WHO IS	Retrieves a name and company affiliation of individual users on the AGNET system.
HELP	Prints out 15 different instruction sets that make up the AGNET users manual, including current list of general and specialized AGNET programs.
WYOPROGS	A list of the specialized Wyoming programs available only to Wyoming users.

TABLE 8: SELECTED MARKET PRICE RETRIEVALS, PLOT AND FORECASTING MODELS ON AGNET

MODEL NAME	DESCRIPTION OF MODEL
MARKETS	Prints current market price data for a variety of commodities and market locations. Commentary files from marketing specialists around the country are also available. Files include livestock and grain futures and cash prices, hay reports, feedlot and terminal markets.
PRICEPLOT	Retrieves future prices that are put on the computer by the Wyoming Department of Agriculture, Cheyenne. User selects the contract month and is given the option to plot either the daily prices or the 3-day moving average.
CASHPLOT	Retrieves and plots selected beef cash prices. Data base used is commodity page, Wall Street Journal. Total year plots can be done daily or every X number of market days.
PRICEDATA	Prints cash and futures prices and/or basis for selected commodities reported in MARKETS program.
MARKETCHART	Prints moving average bar, or point-and-figure graphs for futures contracts of selected commodities. A useful tool in planning market strategies and determining price trends.
CAPRINT3	Prints out table of national cash prices for 12 selected commodities. Prints out every other market day's prices for 60 market days (almost 3 calendar months).
CATTLE	Calculates the feeder cattle (steers) market prices for alternative weights of cattle based on the latest data from Eastern Colorado markets. Can be used to either retrieve recent feeder cattle prices or can be used to project any future contract price over different animal weights.
BEEFADVISORY	Presents specific advisory information and guide to assist feedlot managers in their replacement decisions. Attempts to guide cattle feeders in maximizing expected profits for a year or less planning period (training in interpretation of output required).
SWINEADVISORY	Presents specific advisory information and guide to assist swine production managers in making feeding decisions. Attempts to guide swine producers in maximizing expected profits for a year or less planning period. (training in interpretation of output required).

TABLE 8: SELECTED MARKET PRICE RETRIEVALS, PLOT AND FORECASTING MODELS ON AGNET (continued)

MODEL NAME	DESCRIPTION OF MODEL
CORNPROJECTION	Projects the average U.S. corn price for various corn marketing years. Program employs the traditional balance sheet approach used by marketing and outlook specialists.

TABLE 9: GENERAL AGNET PROGRMAS

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GENERAL AGNET PROGRAMS  -  LAST UPDATE 11/11/81
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PROGRAM NAME                        DESCRIPTION

BASIS          Develops historical "basis" patterns for certain crops
BEEF           Simulation and economic analysis of feeder's performance
BEEFADVISORY   Beef feedlot placement and sales advisory report
BEEFBUY        Comparison of alternative methods of purchasing beef
BESTCROP       Provides equal return yield & price analysis between crops
BINDRY         Predicts results of natural air & low temp. corn drying
BROILER        Simulation and economic analysis of broiler's performance
BUSPAK         Package of financial analysis programs
  ANNUITY      Solves problems involving periodic payments
  BUDGET       Capital budgeting
  CAPITAL      Cost of capital
  CASHFLOW     Discounted cash flow
  DEP          Depreciation
  DEP3         Depreciation (3 methods solved simultaneously)
  EQUITY       Loan equity
  FUTVAL       Future value
  GROWTH       Rate of growth in equity
  IRR          Internal rate of return
  LOAN         Single loan
  LUMPSUM      One-time investment
  MULTLOAN     Multiple loan
  NETDEP       Net declining balance depreciation
  RETURN       Return on investment
CALFWINTER     Analyzes costs and returns associated with wintering calves
CARCASS        Scoring & tabulation of beef or lamb carcass judging contest
CARCOST        Calculates costs of owning & operating a car or light truck
CASHPLOT       Prints a plot of selected cash prices
CONFERENCE     A continuing dialogue among users on a specfic topic
CONFINEMENT    Ventilation requirements & heater size for swine confinement
CORNPROJECT    Projects ave U.S. corn price for various marketing years
COWCOST        Examines the costs and returns for beef cow-calf enterprise
COWGAME        Beef genetic selection simulation game
CROPBUDGET     Analyzes the costs of producing a crop
CROSSBREED     Evaluates beef crossbreeding systems & breed combinations
DAIRYCOST      Analyzes the monthly costs and returns with milk production
DIETCHECK      Food intake analysis
DIETSUMMARY    Summary of analysis saved from DIETCHECK
DRY            Simulation of grain drying systems
DUCTLOCATION   Determines ducts to aerate grain in flat storage bldg
ECON           Package of teaching programs dealing with economic concepts
EDPAK          Demo programs illustrating computer assisted instruction
EWECOST        Analyzes the costs & returns of sheep production enterprise
EWESALE        Lists sheep for sale
FAIR           Scoring and tabulation of judging contests
FAN            Determination of fan size and power needed for grain drying
FEEDMIX        Least cost feed rations for beef,dairy,sheep,swine,& poultry
FILLEDIT       Constructs and modifies files for use in FILLIN
FILLIN         A "fill in the blank" quiz routine
FIREWOOD       Economic analysis of alternatives available with wood heat
FOODPRESERVE   Calculates costs of preserving foods at home
FUELALCOHOL    Estimates production costs of ethanol in small-scale plants
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TABLE 9: GENERAL AGNET PROGRAMS (continued)

GAMES	Package of game programs
GRASSFAT	Analyze costs and returns associated with pasturing calves
GUIDES	Prints available reports of reference material information
HAYLIST	Lists hay for sale
HELP	Lists available programs & items of interest to general user
HOUSE	Estimates the costs of heating and cooling a house
INPUTFORMS	Prints available input forms
IRRIGATE	Irrigation scheduling
JOBSEARCH	Matches abilities and interests to occupations
LANDPAK	Package of programs to assist in land management decisions
BUYLAND	Estimates maximum price you can afford to pay for land
CASHRENT	Estimates maximum cash rent you can afford to pay for land
MINCOME	Calculates minimum net cash income required to make payments
MACHINEPAK	Machinery analysis package
CUSTOM	Calculates breakeven acreage and custom rates
FIXEDCOST	Estimates machinery costs as a percent of new purchase price
GRAINDRILL	Least-cost grain drill analysis
MACHINE	Determination of field machine costs
SEMITRUCK	Estimates cost of operating a tractor-trailor rig
MAILBOX	Used to send and receive mail
MARKETCHART	Prints bar, moving ave., or point & figure charts on futures
MARKETS	Various market reports and specialists' comments
MC	A multiple choice quiz routine
MCEDIT	Constructs and modifies files for use in MC
MICROPROGRAM	Lists programs for microcomputers
MONEYCHECK	Financial budgeting comparison for families
NEWSRELEASE	A program for rapid dissemination of news stories
PIPESIZE	Computes most cost-effective size irrigation pipe to install
PLANTAX	Income tax planning/management program
PREMIUM	Compiles and summarizes fair premiums
PRICEDATA	Prints selected historic cash and/or futures prices
PRICEPLOT	Designed to plot market prices in graphic form
PUMP	Determination of irrigation costs
RANCHADVISORY	Ranch (cow-calf) marketing advisory report
RANGECOND	Calculates the range condition and carrying capacity
SEEDLIST	Lists seed stocks for sale
SOILSALT	Diagnosis salinity & sodicity hazard for crop production
SOYBEANPROD	Demonstration soybean production management model
SPRINKLER	Examines feasiblity of installing sprinkler irrigation
STAINS	Tells how to remove certain stains from fabrics
STATPAK	Package of programs for statistical analysis of data
STOREGRAIN	Cost analysis of on farm and commercial grain storage
SWINE	Simulation and economic analysis of feeder's performance
SWINEADVISORY	Feeder pig and slaughter hog marketing advisory report
TESTPLOT	Standard analysis of variance
TRACTORSELECT	Assists in determining suitability of tractors to enterprise
TREE	Summarization of community forestry inventory
TURKEY	Simulation and economic analysis of turkey's performance
VITAMINCHECK	Checks the level of vitamins & trace minerals in swine diet
WEAN	Performance testing of weaning weight calves
YEARLING	Performance testing of yearling weight calves

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TABLE 10: SPECIALIZED AGNET PROGRAMS

SPECIALIZED AGNET PROGRAMS - LAST UPDATE 4/9/81

PROGRAMS WHICH ARE AVAILABLE TO THE GENERAL PUBLIC, BUT ARE DESIGNED TO BE USED WITH ADDITIONAL MATERIALS AND/OR TRAINING FROM PROGRAM AUTHOR(S).

PROGRAM NAME	DESCRIPTION
AFFORD	Financial budgeting model
AGBUS	Agribusiness management game
ANIMAL	Analysis of gain & feed consumption of experimental trials
BIGMGT	Big management farm supply game
BUDGEDIT	Builds and modifies files for use in BUDGET
BUDGET	General accounting & bookkeeping system
BULLTEST	Used for Nebraska bulltesting program
FARMSUPPLY	Farm supply business management game
FEEDEDIT	Used for building and editing files for the FEEDMIX program
GRADINGPRO	Package of programs used in grading exams and quizes
INSECTCONT	Insect control teaching programs
LIFESTYLE	Lifestyle assessment
LP	Linear programming model
LPEDIT	Used for building and editing files for the LP program
MARKOV	Markov chain analysis - simulating trends of growth of systems
MBO2	Simulation of meat quality in merchandising
PCA	Management decision model for Production Credit Associations
PLANPAK	Package of programs for financial analysis and planning
SOILSPROGRAMS	Package of programs dealing with soil problems and analysis
SORTANIMAL	Random sorting & assignment of animals to pens in experiments
SUPERMARKET	Supermarket business management game
TRANS	Transportation model for allocation between supply and demand
WILDLIFE	Pgms simulating enviromental effects on undomesticated animals

Each of these programs can be executed by typing the program name.

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APPENDIX II

"Six Steps to Take In Making A Decision to Buy a Computer"

Managing By Computer: Is This Tool For You?

Six Steps To Take In Making A Decision To Buy A Computer

By Harlan Hughes
University of Wyoming

Micro-computers represent a relatively new agricultural management tool.

One study indicates that as high as 64 percent of the producers interviewed were planning on buying a micro-computer as a management tool in the next five years. Twenty-seven percent indicated they would purchase a micro-computer in one to two years.

These producers ranked business record keeping as the number one management function they wanted to perform on the micro-computer. The preparation of financial balance sheets, income and cash flow statements ranked second. Breakeven analysis of individual enterprises and crop production records ranked as the third and fourth management functions, respectively, these producers wanted to do on their micro-computers.

In Alberta, Canada, a study of producers presently owning micro-computers indicated they were using them for: 1. Farm planning. 2. Financial record keeping. 3. Physical record keeping. 4. Analysis of records (cash flow, breakeven analysis, and costs of production).

What level of computers do producers own? Sixty percent of the Canadian producers owned Radio Shack and the rest owned Apple, Pet Commodore, Vector Graphics and other machines. A Doane's Agricultural Service study indicates 48 percent of the producers owning micro-computers had Radio Shack, 23 percent owned Apple and the remaining 32 percent owned Commodore, Vector Graphics, and others.

These studies indicate that micro-computers can be an effective management tool; however, a producer-owned micro-computer must pass the same cost/benefit analysis as any other machinery investment. Costs can be easily identified and documented; however, the benefit of improved management is considerably more difficult to document. What is clear, however, is that benefits received depend heavily on the preparation that the cattleman does before purchasing the micro-computer.

A recent farm magazine survey ranked record keeping as the number one function desired to run on the micro-computer. Tax management and marketing information tied for second and third place.

The first step in getting ready to purchase a micro-computer is to study your management information needs. Collection and analysis of management information requires time and money. You cannot afford to collect management information that you do not use or need.

Some questions that you should ask are: What are the most important and significant decisions that I need to make? What information is needed to make the decisions? Can the generation of the needed information be routinized? Can a micro-computer make this information collection easier? Studying your information requires some time and effort. It may well be worth your time to hire a consultant or visit with your university extension service and get a second opinion.

Harlan Hughes

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The second step in getting ready to purchase a micro-computer is to identify what computer programs (software) are available that might meet your management information needs. A cattleman has four potential ways he can obtain his needed software. He can (1) buy it from a commercial vendor, (2) obtain it from his Extension Service, (3) hire it custom programmed, or (4) program it himself.

If the software needed is available from a commercial vendor, this may well prove to be the most satisfactory method of acquiring software. Quite often, however, what a cattleman needs is not available from a commercial vendor. The local Extension Service may have what is needed. Often the only viable alternative is to hire a program custom-programmed or program it yourself. Unless a person has some unique training or a lot of spare time, I cannot recommend that he program it himself. Obtaining software tailored to a cattleman's specific needs will be the most difficult and frustrating task.

Step three is to determine the hardware specifications required to execute the needed software. The size of the business affects the volume of management information needed and this, in turn, determines the size of hardware needed. Micro-computers come in different sizes (memory units), have different storage capabilities on the diskette (floppy disc), and have different add-on capabilities (80 column screens, upper and lower case characters, computer languages, CP/M operating systems, telephone modems, word processing software, etc.).

Again, it is recommended that a consultant or the Extension Service be contacted. Computer dealers are not necessarily the best information sources for determining specific hardware needs. Generally, they promote what they have to sell.

Step four is to contact local hardware dealers and determine what are the viable hardware alternatives. Cattlemen should use the same criteria that they would use for any other equipment purchase — this includes dealer knowledge of his own hardware, quality of the service department, apparent financial stability of the dealer's business, and in general, how you would feel about doing business with the dealer. Since cattlemen have purchased equipment before, they should feel reasonably comfortable with this step.

Step five is to estimate the cost/benefit of the proposed computerized management information system. A dealer can tell you exactly what the hardware will cost. Remember that you can take investment credit and fast depreciation on computer hardware.

By now, a cattleman should have an estimate of what the software will cost. Don't forget to include the clerical cost of collection and processing the management information. This frequently is the wife's or cattleman's time. Collecting and typing data into the computer is time consuming and boring. Cattlemen might even consider hiring a person to be specifically responsible for the data processing of the management information.

Costs of the total management information system can and should be projected. A Michigan State University study indicates that it may cost $500 to $600 a year to process a producer's business records through his own micro-computer. Again, an outside consultant can be useful.

Estimating the dollar benefit of having a computerized management information system is difficult for most cattlemen to do. Today's high costs of production and high interest rates do not leave much margin for management errors. Just preventing one management error a year may well pay for the micro-computer system. The ability to experiment wit decision on paper before implementa may, well justify a micro-computer

The final step is to make the decis to set up or not to set up a computeriz management information system. Catt men should consider talking to oth cattlemen that already own micro-co puters. Many states are also offeri educational seminars for ranchers a farmers to learn more about hc micro-computers can enhance a pr ducer's decision making process. T final decision rests with you, t individual cattleman. There is no blank recommendation that will fit all situ tions. Micro-computers can, howeve be an effective management tool.

Micro-computers are becoming a mo common management tool for cattleme Innovative producers are purchasin micro-computers to enhance their pe sonal management information system This article summarizes six recon mended steps that cattlemen should g through in making the decision t purchase a micro-computer. If these si steps are followed, a person will have higher probability of a successful exper ence with his first micro-computer.

Today's low profit margins and hig interest rates will place a premium on cattleman's management informa system. Purchasing a micro-comp may prove to be one of the few profitab equipment purchases of the 1980's Certainly, successful cattlemen will b spending more and more time in th 1980's developing and working wit their management information system Automation of a cattleman's manage ment information system lends itself to micro-computer.

Editor's note: Harlan Hughes is Agri Coordinator and Associate Professor in th Division of Agricultural Economics at th University of Wyoming.

Glossary Of Computer Terminology

Abort: The process of stopping a running program in an orderly fashion.

Acoustical coupler: A device for connecting the telephone handset to the computer input port.

Add-on: Hardware that can be added to an existing system to increase capacity performance.

Algorithm: Any step-by-step procedure to make the computer perform a desired task.

Alphanumeric: The set of all alphabetic characters, numeric characters and punctuation characters.

ANSI: American National Standards Institute. This organization sets standards for many aspects of computer technology.

APL: A Programming Language. A high level language for special applications.

Applications software: A program that performs a specific function, such as processing feed yard management data or accounting data.

ASCII: American Standard Code for Information Interchange. Character code used for representing information in most non-IBM equipment.

Back-up copy: A copy of a program o data base preserved in case the original i lost or accidentally made unusable.

Bank: A group of memory chips tha operates as a single unit of memory, suc as a 64K memory.

BASIC: (Beginner's All-purpose Sym bolic Instruction Code) A simplifie programming language widely use novices.

Baud: Refers to the speed at whic information is moved from the CP (central processing unit) to the termina or printer.

Benchmark program: A sample pro-

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APPENDIX III

"Now That You Have Decided to Buy a Microcomputer -- What's Next?"

by

Ted Nelson
Oklahoma State University

OKLAHOMA STATE UNIVERSITY
Dept. of Agricultural Economcs
Extension Farm Management
Ted R. Nelson
March, 1981

NOW THAT YOU HAVE DECIDED TO BUY A MICRO-COMPUTER--WHAT NEXT?

Before You Buy!

Once you have made it through the agonizing process of deciding that you can no longer get along without having that modern wonder of technology and you have worked out the money problem in your mind it is only human to get right into it and bring home the new "baby". Suppress that urge- for a little while and recheck your goals. "Reset" and decide:

- A. What job(s) are really important to you.
- B. What software is most important to you and where you will get it and what it will cost.
- C. That you will devote several hours a week for several weeks getting familiar with the operation of the machine and the programs.

Once these conditions are resolved, go ahead and get the best deal you can considering the software, service and prices for any of the established brands.

Among the established brands it is my opinion that they all do a good job of running the software designed to run on them: but there are important considerations:

SERVICE- Is the repair procedure satisfactory to you? (Sooner or later it will be needed).

SOFTWARE- Are acceptable programs available at the right price?

Now That You Have a Machine!

1. GET ACQUINTED- With the manual. It is time-consuming, YES, BUT it will save a lot of time later if you really understand the Operating System (Whether you use "canned" programs or do your own.
2. GET SOME PROGRAMS- Be prudent and be sure you will use them before you lay out bigbucks, but you can learn a lot by seeing how some other programmers do things--and they give you something concrete to work with.
3. DIG INTO THOSE PROGRAMS- If they are in BASIC, you can hit BREAK at any time and see what line they are working on; then LIST the surrounding lines and tell what is going on and how it is done. A critical point in all programs is at the "Main Menu". Write down that line# so- when the program breaks with data in it, you will not endure the frustration of loosing all that information by starting the program "from the top". Just type GOTO Ln# and get back to the place where you can try it again.
4. LEARN to EDIT so you can personalize your programs to do it YOUR WAY if you feel the need.
5. RECOGNIZE that some "BlackBox" programs or routines are needed.

Programs- BASIC vs. OTHER-

Acquiring programs is complicated by the wide variety of forms in which programs are available. Several definitions are useful:

INTERPRETIVE Languages are those for which the instructions (Source Code) are changed into machine instructions as the program is executed, BASIC on most micros is an example. The best thing about them is that they are easy to program and to modify using the EDIT features. The machine instructions are never stored, either in memory or on disk, but are used momentarily as they are created when the program is executed.

Advantages= 1. Lower programing cost. 2. Easy to change. 3. Relatively easy to translate between brands. 4. They come with the machine at no extra cost.

Disadvantages= 1. Slow execution and loading. 2. Functions limited to those provided by the dialect of the language used. 3. Difficult to maintain proprietary control.(From the author and vendor's point of view.)

COMPILERS convert source statements to Load Modules for more efficient storage and execution- Examples are FORTRAN(FORmula TRANslator) & COBOL(COmmon Business Oriented Language).

Advantages=1. Five to ten times faster loading and execution. 2. Distribution of load modules rather than source code protects proprietorship.

Disadvantages= 1. Must buy the compiler ($100-Up.) 2. More difficult for user to change.

ASSEMBLERS create very efficient load modules which require minimal space to store and execute very fast with maximum availability of functions possible on the machine.

Advantages= 1. Very fast execution. 2. Protected code.

Disadvantages= 1. Tedious, slow (expensive) to program. 2. Very difficult to modify.

DOS who?

DOS is computereeze for DISK OPERATING SYSTEM. It does for the micro with disk the control functions and additional interpreting and utility functions that the ROM(-Read Only Memory) chip usually does for the system with no disk drives. Machine vendors usually supply a DOS disk with the first disk drive purchased, and it is different for each model. Updated (improved) versions are released from time to time and packed with equipment shipped after the release date.

The version supplied by the vendor is "supported" by the vendor; i.e. It is designed to work with the peripheral equipment (printers,-etc.) sold by that vendor and if serious errors are discovered a free replacement will often be supplied.

Other DOS's such as NEWDOS, VTOS, CP/M, etc. are for sale by various software houses which contain additional or special features- These often have to do with management of disc files, improved source--code editing properties or more convenient communications capabilities.

Some of these are compatable with the original DOS. Others are not because they are created to provide a common operating system for the purpose of transfer of programs between brands and models of computers.(Such as CPM).

Advantages= 1. Compatability of programs between brands and models, allowing multi-brand distribution of programs.

Disadvantages 1. Extra cost ($100 up) for the DOS. 2. Inability of users who do not have it to use programs created for it.

So-- WHAT DO I BUY?

The choices are many, but so are the objectives and sophisication of users, so there is no "pat" answer to what fits where without examining the specific application. That's part of management!

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APPENDIX IV

"Interfacing Farmer-Owned Computers to Extension Computer Systems Like AGNET"

INTERFACING FARMER-OWNED COMPUTERS TO EXTENSION COMPUTER SYSTEM LIKE AGNET

by

Harlan Hughes and Karen Holman[1]

MICROCOMPUTERS

Microcomputers are the latest electronic devices to come on the scene. These are often called "home computers" or "small business computers." A microcomputer is a low-priced stand-alone computer priced from $500 up to $10,000. Microcomputers will impact on extension in both county agents' offices and directly on farmers and ranchers. Let's take a look at both of these applications.

Microcomputers in County Extension Offices

Utah State University is presently piloting the use of Apple microcomputers in county extension offices. According to Larry Bond, they plan to use the micro to maintain 4-H enrollment records, mailing lists, budgets, Semis reports, etc. In addition, Larry is designing and collecting a library of management decision aids for the Apple microcomputer. Recently, I attended the Rocky Mountain Section of the Society of Agricultural Engineers meeting in Laramie, Wyoming. Utah State Agricultural Engineers reported on two irrigation applications that they have put on the Apple. One dealt with projecting water requirements for lawns in Salt Lake City and the other dealt with projecting water needs of agricultural crops. I assure you that Wyoming is looking to Utah to learn how the microcomputer fits into the day to day activity of a county extension office.

Microcomputers on Farms and Ranches

Wyoming farmers and ranchers are starting to show some interest in owning microcomputers. The College of Agriculture is receiving inquiries from farmers and ranchers about microcomputers. Wyoming held a mini-conference on microcomputers in May, 1980.

There are three farm and ranch applications that may justify a Wyoming rancher owning his own microcomputer. The applications are:

(1) Business accounting,
(2) Herd performance,
(3) Financial management.

Let's look at each of these applications individually.

I recently had the opportunity to attend a Nebraska conference on farm computers and to talk to several Nebraska farmers that owned their own microcomputers. It soon became evident that the present cost-price squeeze was the motivating force for farmers owning their own microcomputer. They were using the micro to keep their accounting books current. Some argued that they needed their cash flow positions current at all times. Their microcomputer's accounting system made that process easier.

Many ranchers realize that a microcomputer can easily provide them with more and better herd management reports. A microcomputer will permit the herd master file to be more easily updated. Once the data is in the computer, the computer can quickly sort and print out several useful management reports. With a microcomputer, the herd management reports can be generated before the manager has to make the herd management decisions.

More and more bankers are requiring financial statements, operating statements, and cash flow projections from ranchers and farmers. The cost price squeeze is also increasing farmers' and ranchers' interest in knowing where their operation is financially. Financial statements, operating statements and cash flow projections can be developed with a microcomputer. Once developed, they can be more easily updated with the microcomputer. This will permit a rancher to know exactly where he is financially before he makes major financial decisions for his business.

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[1] Harlan Hughes is AGNET Coordinator and Karen Holman is AGNET Programmer, University of Wyoming, Laramie, Wyoming. Paper presented at conference on "Computer Applications to the Beef Cattle Industry," Wichita, Kansas, May 27, 1981.

HARDWARE NEEDS FOR A PRODUCER-OWNED HOME COMPUTER

A business accounting system, a herd performance system, and a financial management package are going to require a disk oriented microcomputer system. A dual disk system will be necessary so that back-up copies of disk files can be made. A good printer is also needed for output reports and certainly is needed for audit trails. A cassette recorder is often nice to have when you get outside software. Some software is now being transferred by disks but cassettes are still common. The processing requirements of the home computer system will require at least 32K to 48K bytes of memory (where K=1000).

A rancher or farmer should plan on spending at least $4,000 to $5,000 for a 32K or larger system with dual floppy disks and a good printer. While this is considerably more than the $500 microcomputer advertised on TV, this is about what it will take to do what a farmer or rancher will want their home computer to do. It does not take much of a management improvement to make $4,000 to $5,000 difference in profit today.

INTERFACING PRODUCER-OWNED HOME COMPUTERS WITH AGNET

Microcomputers can be equipped with a telephone coupler that can be used as an AGNET terminal. With this $300 attachment, the producer-owned micro can be used to call up the 200 plus programs in the AGNET library.

When producers purchase the option to use their microcomputer as a terminal into AGNET, they have the best of two worlds:

(1) They can use their micro for stand-alone processing of routine business accounting, herd performance, and financial management, and

(2) They can also access the centralized libraries of Computerized Management Aids in AGNET on as frequent or infrequent basis as desired.

ACCESSING THE AGRICULTURAL INFORMATION NETWORK WITH A PRODUCER-OWNED HOME COMPUTER

Ranchers are expressing considerable interest in the "AGRICULTURAL INFORMATION NETWORK" now available on AGNET. Wyoming is using the AGNET mainframe computer as an electronic filing cabinet for a large amount of agricultural information. Users are provided with an up-to-date menu of the information filed in the computer and they can choose what information they want to see.

Ranchers and farmers can now use their microcomputer to:

(1) Retrieve today's market prices. They can also retrieve past prices for comparison. South Dakota State University and the University of Nebraska marketing specialists are providing producers with a weekly analysis of cattle and grain price trends and what is causing the trends.

(2) Obtain current outlook reports and interpretations from market analysts around the country. Bob Price, Western Livestock Market Information Project in Denver, puts on outlook and analysis information that should be of considerable interest to Wyoming producers.

(3) List his hay for sale, sheep for sale, or pasture for rent. If he wants to buy hay, sheep or rent pasture, he can check who has listed these items for sale.

(4) Review current and timely news releases available on agriculture, consumer economics, and home economics. USDA as well as Ohio are putting on current information of value to Wyoming producers.

(5) Producers can send electronic mail directly to his county extension office. Written recommendations can be electronically sent to the producer from his local county extension office or state office.

(6) Transmit range (drought) conditions to county, state and regional offices (Western Livestock Market Information Project office in Denver). Information can rapidly flow from producer to county to campus as well as from campus to county to producer.

COMMUNICATION LINKAGES TO AGNET

The Wyoming AGNET staff is presently working out procedures for interfacing microcomputers to the AGNET system. The AGNET computer appears to be one of the harder mainframe computers to link to. As of to date, Wyoming AGNET has made this linkage with a Pet Commodore model 2001, and the newer CBM system, Radio Shack model II, and an Apple II Plus. As resources become available, AGNET Wyoming will continue to develop communication interfaces with other brands of microcomputers.

Microcomputer users are cautioned that frequently standard microcomputer hardware and vendor supplied software will not interface with AGNET. You are strongly encouraged to actually make the interface before paying for your equipment and software. Good intentions from your equipment dealer do not help much if your equipment will not interface. I can quote you several cases where the microcomputer owner is quite frustrated to find out his microcomputer is not configured to interface with AGNET.

We believe that the secret to having a successful interface is based on (1) how you configure your system and (2) on what software you are trying to use. For example, ASCII Express seems to work for most Apple II configurations. ASCII Express can be purchased from any Apple dealer for around $65. Without ASCII Express we know of certain Apple II configurations that will not interface with AGNET.

In summary, we advise people to test and actually do the interfacing before you pay for your equipment. Plan on purchasing some software to facilitate the interfacing.

Give us a call at 307-766-2107 and we will be glad to share with you what we have learned about interfacing microcomputers to AGNET. If we don't know the answer (and the odds are we won't), we'll be glad to work with you. That's how we learn. As we work with individuals we are building up some expertise so that eventually we will have a databank of answers to the interfacing challenges. AGNET Wyoming is convinced that interfacing microcomputers into mainframe computers is the wave of the future. This kind of distributive processing system is certainly the direction agricultural computers will go.

APPENDIX V

"Microcomputer Magazines Sample List"[1]

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[1] Source: Arlin J. Brannstrom, "Microcomputers in Farm Management", paper presented at American Society of Farm Managers and Rural Appraisers Annual meeting, Louisville, Kentucky, November 5, 1981, page 9.

MICROCOMPUTER MAGAZINES SAMPLE LIST

The following is a partial list of representative microcomputer magazines. Those interested in learning more about microcomputers are encouraged to read as much as possible.

BYTE. Published by BYTE Publications, Inc., 70 Main St., Peterborough, NH 03458. BYTE is one of the oldest and most widely read microcomputer magazines. Each issue contains several hundred pages of advertising for various software packages, and hardware components. Some articles may be too technical for the beginner, but this is a magazine which is definitely worth looking at.

Creative Computing. Published by Creative Computing, P. O. Box 789-M, Morristown, NJ 07960. Creative Computing tends to target the personal computer market. Separate columns are included for owners of Apples, TRS80's and Commodore Pets.

Interactive Computing. Published every other month by Association of Computer Users, Inc., P. O. Box 9003, Boulder, Colorado 80301. It contains benchmark reports for many microcomputer systems.

Interface Age. Published by McPheters, Wolfe & Jones, 16704 Marquardt Ave., Cerritos, CA 90701. Interface Age is geared more toward the small business microcomputer user. It features benchmark reports for various microcomputer systems and evaluations of business software packages.

Kilobaud Microcomputing. Published by Wayne Green, Inc., 80 Pine St., Peterborough, NH 03458. Microcomputing is another excellent magazine. Features tend to vary from small business to hobby to education.

MICROSYSTEMS. Published by Creative Computing, 39 East Hanover Ave., Morris Plains, NJ 07950. This is a bi-monthly publication which focuses on the CP/M, S-100 microcomputer.

onComputing. Published by onComputing, Inc., 70 Main St., Peterborough, NH 03458. onComputing is a magazine geared for the first-time user. I particularly recommend an article by Larry Press called Getting Started in Personal Computing in the Spring 1981 issue.

APPENDIX VI

"Glossary"

Source: A. J. Brannstrom, "Microcomputers in Farm Management", paper presented at American Society of Farm Managers and Rural Appraisers Annual meeting, Louisville, Kentucky, November 5, 1981, pages 10-12.

GLOSSARY

Applications Software: A program (or group of programs) that performs a specific business function, such as accounting or payroll.

ASCII: (American Standard Code for Information Interchange) A common standard for representing numbers and characters inside a computer.

Assembly language: A low-level language used where high speed and small program size are important.

Basic: (Beginner's All-purpose Symbolic Instruction Code) A relatively easy-to use language that comes with many small computer systems.

Batch Processing: Programs and data are stored in files and processed all together in a "batch."

Baud Rate: The speed at which information is exchanged over communication lines. Usually baud rates are ten times the number of characters per second transmitted.

Binary: The basis for calculations in all computers, this two digit number system consists of digits 0 and 1 which are represented in the computer's processor as the presence or absense of a small electrical pulse.

Bit: The smallest unit of information that the computer recognizes. A bit is equivalent to the presence or absence of an electrical pulse.

Bug: An error in a computer program.

Byte: A group of bits (usually 8). A byte is used to represent one character (number or letter) of information.

Chip: A thin silicon wafer on which electronic components are deposited in the form of integrated circuits.

COBOL: (COmmon Business-Oriented Language) A high-level programming language widely used in business applications on large computers.

Computer Program: A collection of instructions that together instruct the computer to perform a desired task.

Compiler: A special program that converts a programming language into code the computer processor can read.

CP/M: A general purpose operating system, developed by Digital Research Corp., that has now become a standard for many microcomputers.

CPU: (Central Processing Unit) The part of the computer that controls the interpretation and execution of the processing instructions.

CRT: (Cathode Ray Tube) A television-like screen which may be used for viewing data and program instructions.

Data: The raw information within a computer system.

Data Base: A collection of interrelated data that is organized for ease of update and retrieval. For example, a livestock data base would include the health and breeding information for a herd of animals.

Density: A term used to describe the distance between magnetic information on tapes or floppy disks. The higher the density, the more information storage capability.

Disk: A revolving plate upon which data and programs are stored.

Downtime: The period during which a computer is not operating because of a machine failure.

File: A collection of related records; a ledger for example.

Editor: A utility program that allows a user to enter and manipulate data files.

FORTRAN: (FORmula TRANslation) A high level language widely used for scientific and engineering problems.

Hardware: The physical components of a computer system.

Input: The data that is entered into the computer; the act of entering data into a computer.

Interface: The juncture at which two computer components meet and interact with each other.

K: Computer shorthand for the quantity 1024; the term is usually used to measure computer memory capacity.

Machine Language: A program - consisting of a string of 1's and 0's - that the computer can understand directly.

Memory: The section of the computer where instructions and data are stored.

Menu: A list of alternative actions displayed on the CRT for selection by the user.

Microcomputer: A small computer in which the CPU is an integrated circuit deposited on a silicon chip.

Modem: (MOdulator-DEModulator) A device to allow computer signals to be sent and received over telephone lines.

Operating System: A series of programs generally provided by the computer manufacturer to perform the computer's basic functions such as reading the input from the keyboard, or copying one disk to another.

Output: The information printed by the computer.

Peripheral: A device attached to a computer (for example, the CRT or printer).

Printer: A peripheral device to record computer output on paper. Three major types of printers exist for microcomputers: thermal printers, character printers, and dot matrix printers.

Program: A set of coded instructions directing a computer to perform a particular function.

Programming Language: A set of words and rules that constitute a language understood by the computer and the programmer alike.

Response Time: The time required for the system to respond to a user's request or to accept user's inputs.

Software: A general term for computer programs and documentation involved in the operation of the computer.

Storage: The portion of the computer devoted to holding information while it is not needed by the CPU.

System: The CPU and all peripherals.

Terminal: A device to communicate with the computer. (Usually through a keyboard and a CRT or on printed paper.)

Throughput: A measure of the amount of work that can be accomplished by the computer during a given period of time.

Timesharing: A method of sharing the resources of the computer between several users. Computers are much faster than the poor humans who operate them. Thus several people can appear to be running different computer tasks simultaneously through a timesharing system.

Turnaround Time: The measure of time between the initiation of a job and its completion by the computer.

Word: A group of bits that the computer stores in one location in memory.

Word Length: The number of bits that can be stored in one memory location.

APPENDIX VII

Communications With Microcomputers

COMMUNICATIONS WITH MICROCOMPUTERS[1]

by

Harlan Hughes and Robert Price[2]

Wyoming is now communicating to AGNET with a Pet Commodore and an Apple II Plus on a regular basis as each microcomputer is equipped with a telephone coupler. We simply dial the AGNET computer from the keyboard of the microcomputer. The coupler for the Pet is a TNW488-103 running with a slightly modified PTERM103 software package that collectively cost $540. The coupler for the Apple is a D. C. Hayes and their associated software that collectively cost $300.

Pet

The Pet's PTERM103 software program is a flexible package that allows us to effectively use the Pet as a "dumb terminal" to AGNET. One starts a terminal session by loading the program which we have renamed "AGNET." After loading it you type in RUN and a menu shows up on the screen. The menu is:

ANSWER, CALL, DISPLAY, EXIT, HANG-UP, SET, TEST, USER, CR.

While I will not take time here to explain all of the commands in the menu, there are several command options available. I can call in any of the options by typing in just the first letter of the option name. For example, to call AGNET just type in a "C". Since it also has the AGNET telephone number stored in the PTERM103 software, I can retrieve the AGNET telephone number by typing in "N1." The software takes over and automatically dials the AGNET computer. From this point on the microcomputer is under control of the AGNET computer and operates just like a "dumb" terminal.

The PTERM103 software does allow one to interrupt the AGNET control and return to the PTERM103 menu. This in turn allows the microcomputer user to turn the microcomputer's printer on or off as desired. This is a very useful feature when using a microcomputer as a terminal with AGNET. With the interactive sessions you often only need hard (printed) copy of a portion of your terminal session. By being able to turn the printer on and off, you save a considerable amount of paper.

Apple

The Apple coupler operates in a similar manner. You first invoke the D. C. Hayes by typing in "IN#3", then you command the modem software with the "Control A". "Control H" puts the modem in half duplex as required by AGNET. A "Control A, Control Q" allows you to dial AGNET. Once AGNET answers, you operate your microcomputer just as if it was a dumb terminal.

While it took a while to discover, we are now able to turn the printer on and off during AGNET sessions. You first must get out of the Apple terminal mode by hitting the "Control A, Control R" and return. This puts you in Applesoft mode so that you can turn the printer on by a PR#1. You now get back into Apple terminal mode by hitting "Control A, Control H." You are now printing the output. You can turn the printer off by inserting PR#0 in place of the PR#1. We also find that we cannot use the printer on/off routine on the CDC mainframe computer.

Using the Apple as a Smart Terminal

Microcomputers have the power to do considerably more than operate as a dumb terminal to a mainframe computer. With its logic ability, a microcomputer can operate as a "smart terminal" when connected to a mainframe computer; however, a smart terminal software package is required. The authors are aware of three smart terminal packages for the Apple microcomputer. They are:

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[1] This is a revised version of an earlier paper written in October, 1981. This paper is as of January 25, 1982.

[2] Harlan Hughes is AGNET Coordinator, University of Wyoming, and Robert Price is Senior Economist, Western Livestock Market Information Project, Denver, Colorado.

1. ASCII Express
2. Data Capture
3. Visiterm

ASCII Express

For $60 you can purchase a smart terminal software package for the Apple called ASCII Express. This software package was developed by Southwestern Data Systems. This program stores the name and phone number for up to 18 mainframe computer systems in a menu-driven format. Each system can have a separate set of keyboard macro definitions to help you log on to each specific machine. With just a few key strokes, you can call up and log on to any system.

The ASCII Express is equipped with a buffer that can be used to capture incoming data (downloading) or to send data up to the mainframe (uploading). Any DOS file can be uploaded including Integer BASIC, Applesoft BASIC, text, and binary files. Utility programs are available to help with the uploading and downloading. A fairly powerful edit routine is also part of the package. We find the edit routine very useful.

AGNET Wyoming has ASCII Express and we find it very useful. It had opened up several doors to information networking that we are presently using on AGNET. We are uploading electronic mail, news releases, and market information on a regular basis. We are downloading information from the CMN system and uploading that information to the AGNET computer.

Data Capture

Southeastern Software sells a smart terminal package called Data Capture for $65 (eighty-column versions sell for $90). This program also operates with a buffer that is used for uploading and downloading. It has a unique feature of a buffer status line with a continuous display telling you at a glance how many lines have been captured in the buffer. It will also automatically save the buffer on disk whenever it fills up. AGNET Wyoming does not have the Data Capture Program, but we have used it briefly on someone else's micro as a dumb terminal and it was easy to use. The edit program appears to be very limiting.

Visiterm

Visiterm is a part of the new software series from Personal Software. Visiterm costs $129 but has many innovative features that make it a very flexible smart terminal package. Visiterm allows a wide range of protocols for sending text. Programs can be sent after the usual conversion to text files. Visicalc-generated files can also be send with Visiterm.

AGNET Wyoming has briefly tested this package and found it has one major limitation. We could not print the output while receiving it from the mainframe. We consider this unsatisfactory as a communications package.

Communications With CP/M Operating Systems

WLMIP is now communicating with AGNET using a Vector equipped with the D. C. Hayes micromodem 100 and associated software. The cost for the package is approximately $500.

The Hayes software is invoked by byping "MM100". The commands in the Hayes software are invoked by doing a Control A. This allows you to set duplex to half, make parity settings, dial the computer and other necessary commands.

The standard Hayes package does allow the CP/M microcomputer to operate in the dumb terminal mode with AGNET. However, it does not support features to allow uploading of data files. WLMIP is extensively searching packages that are compatible with the operating system used for AGNET. As of October 1, 1981, no packages had been discovered that would incorporate the uploading features.

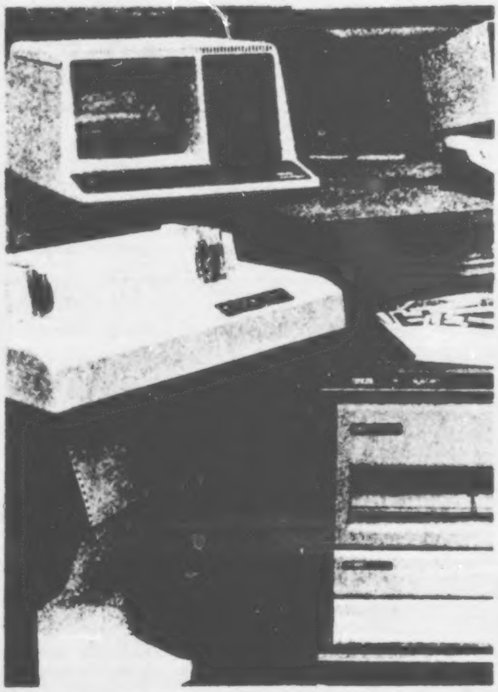
The MM100 for CP/M operating systems is equipped with a command invoked by typing a "Q" which allows the user to turn the printer on (Q1) or off (Q0) at any time during the terminal session. There is also a capture buffer that allows you to download information from a mainframe and capture it on a disk file in the microcomputer. This capture buffer can be turned on and off at will during the terminal session. However, it does not automatically write to disk when full but instead empties itself and begins capturing over again at that point.

The author of the MM100 has now provided a revised version that allows us to upload from the Vector Graphics to AGNET and CMN. Instead of checking for the Control Q promptor message sent by AGNET, the software has a one second delay built in. It waits for one second and then sends the next line to AGNET. This works OK for data files, but does not allow the stacking of program instructions. We will continue to work with the author on this.

Information networking is rapidly becoming the wave of the present. Microcomputers equipped with telephone couplers turn a micro into a logical device to access information networks. We estimate that uploading can reduce telephone time by 30-50 percent. The economic incentive to develop some top quality communication packages is very high.

FACTS

COOPERATIVE
EXTENSION
SERVICE
PURDUE
UNIVERSITY
WEST LAFAYETTE
INDIANA



FAST AGRICULTURAL COMMUNICATIONS TERMINAL SYSTEM

The Cooperative Extension Service uses a variety of teaching and demonstration techniques to assist clientele. FACTS is a tool which effectively uses relevant information for educational service. This distributed computer network provides rapid detailed information dissemination, a memory capability for recalling data, and a computing capability for quick analysis and individualization of problem solving for developing alternatives.

Background

The FACTS system planning and development began in 1977 with a grant from the W. K. Kellogg Foundation. State and county financing and private contributors purchased terminals for all 92 Indiana counties.

Agents, specialists, and others working with the FACTS system have had input into the development of the programs, which are listed by title with a brief description on the reverse side of this page. FACTS is destined to remain a user-oriented system which serves the citizen clientele in every county in Indiana. Educational information and computer programs will be provided by Purdue University, based on client needs, provided that resources continue to be available.

FACTS' Future

The objective of the FACTS system is basically to identify those circumstances in which the unique capabilities of the system enhance or improve the basic function of the Extension operation. In the initial phase for implementing FACTS, the following guidelines have been established:

- In information communication, FACTS will be used in those instances where *speed and up-to-datedness* are of primary importance in making information useful. It is not used to replace the printed word, mail, or telephone for the general distribution of information.
- In memory applications, FACTS will be used for those operational management situations in which large quantities of repetitive material are used, such as mailing lists, program enrollments, and instances where regular, periodic minor up-dating of technical bulletins, etc., is necessary.
- In its problem-solving capacity, the potential use of the system far outreaches the resources available to FACTS. In the immediate future, development priorities will concentrate on:
  a. Those instances in which individualized data of the client is helpful to his decision-making.
  b. Those situations in which the limited specialty resources either on the campus or in the field preclude effective personal teaching relations; thus, FACTS can be a true *extender* of scarce resources to great numbers of clientele with specialized problems.
  c. Those situations in which there is a reasonable time of operation and simplicity of user input. The programs should also have broad and long-term use.
  d. Those situations which are complex and require the interaction of several disciplines or specialities of campus staff, including interaction with other computers.

It is evident that the future of FACTS and computer technology is bright in all counties for Extension program areas (Agriculture, 4-H, Home Economics, Community Development). The FACTS terminals are owned and maintained in the Cooperative Extension offices by county government and will continue to be an important information resource.

BUDGET FX-1 (HE): Client input produces three budgets tailored to a specific family.

FOOD COSTS FX-2 (HE): Designs a food spending plan for individuals and families.

COST OF CHILDREN'S CLOTHING FX-3 (HE): Clients compare their present spending patterns with standard clothing budgets for children.

HOME VEGETABLE GARDEN PLANNING PROGRAM FX-4 (HO): This program will design a vegetable garden for family use.

FIELD EQUIPMENT CALCULATOR FX-5 (AE): Collection of programs to assist the farm manager with routine machinery management calculations.

INDIANA STATE 4-H ENROLLMENT SYSTEM FX-6 (4-H)

GREENHOUSE PLANT COST ESTIMATION PROGRAM FX-8 (HO): Program estimates individual greenhouse-grown plant costs for pot crops or costs per square foot of production.

FEEDING PROGRAMS FOR HORSES FX-9 (AS): Collection of programs and management suggestions for proper horse nutrition.

FARM BUILDING PLAN SERVICE CATALOG FX-10 (AE): Plans available for specific types of farm or residential buildings or livestock equipment.

DOUBLE CROP FX-11 (AY): Produces a budget sheet and computes the profit potential for full season and double cropping.

RATIONS FOR BEEF CATTLE FX-12 (AS): 1. Winter rations for the breeding herd. 2. Growing and finishing rations for steers and heifers.

RATE OF RETURN/PRESENT NET WORTH FX-13 (FNR): Costs and/or benefits associated with a financial alternative.

INSTALLMENT LAND CONTRACTS FX-14 (EC): May be used for any type of installment type purchase schedule of payment.

WEATHER REPORTS FX-15 (AY): For receiving, displaying, and printing daily weather forecasts.

REAL ESTATE TAX TABLE GENERATION FX-16 (EC): Produces a table of net valuations.

MAXIMUM BID PRICE FOR LAND CALCULATOR FX-17 (EC): The "Maximum Bid Price" model helps a user determine how much could be bid for land under specified return assumptions.

MAIL PROGRAM FX-19 (ADN): This version of the mail program allows the user to receive, read, and print messages.

WEATHER INDEX CALCULATOR FX-20 (AY): A Weather Index is used to describe the combined effects of weather.

CROP PEST MANAGEMENT FX-21 (E): Programs designed to aid clients interested in pest management.

CLEAN: STAIN REMOVAL FX-22 (HE): This program is designed to retrieve, understand and use most effectively the available instructions for removal of stains from fabrics.

SOYBEAN SEEDING RATE PROGRAM FX-25 (AY): This program gives recommended populations and calculates the seeding rates required.

INCOME TAX MANAGEMENT FOR FARMERS FX-27 (EC)

BLITECAST FX-28 (BP): Program designed to warn potato growers of potential late blight.

COPY FX-29 (ADN): This program will make an image copy of any diskette.

PORK CARCASS PERFORMANCE EVALUATION FX-30 (AS): Program designed to analyze swine carcass and performance data.

HOME INSULATION ANALYSIS FX-31 (AE): The program provides information on insulation levels needed.

MAILING LABELS PACKAGE FX-32 (ADN): A set of programs for maintaining a data base of address label information.

GRAIN MARKETING ALTERNATIVES FX-34 (EC): Program designed to assist farmers and elevator managers in evaluating grain marketing and storage alternatives.

RETIRED COUPLE'S BUDGET FX-35 (HE): A guide to help a retired couple review and evaluate budgeting practices.

FEEDER CATTLE BREAKEVEN FX-36 (EC): Designed to aid feedlot operators in evaluating the profitability of finishing feeder cattle.

PLANT DISEASE PROFILE FX-37 (BP): A large data base that provides information about specific plant diseases and disorders.

PRESERVE FX-39 (HE): A data bank of answers to food preservation questions.

CHARLIE CAREERS FX-40 (AI): CHARLIE CAREERS—Computer Help to Aid Research Locally in Education—School of Agriculture information about study and career opportunities in agriculture.

NUTRI 1: SELECTED NUTRIENT COMPOSITION FX-41(HE): Provides planned diets related to cholesterol, iron, potassium, and sodium.

PROGRAM PLANNERS' GUIDE FX-42(ADN): Program planning steps for FACTS applications.

FEEDER PIG BREAK-EVEN FX-43 (EC): Designed to aid producers in evaluating the profitability of finishing feeder pigs.

ALFALFA INSECT INFORMATION AND IDENTIFICATION PROGRAM FX-54(E): Identification key and economic information.

ALFALFA DIAGNOSTIC GUIDE FX-74(E): Identifies insects, nematodes, weeds, herbicides, disease, and other factors.

SOYBEAN DIAGNOSTIC GUIDE FX-75(E): Soybean problem determination.

CORN DIAGNOSTIC GUIDE FX-76(E): Corn problem determination.

CROPLAND LEASE COMPARISONS FX-77(EC): Crop lease alternatives and returns realized.

CROP FAN MATCH (CFM) GRAIN DRYING AND AERATION FAN SELECTION—APPLICATION FX-78(AE): Calculates the air flow delivered and the horsepower required or used in drying or aeration.

BANNER FX-79(ADN): Used to create and print block letter banners.

EVALUATING BASIC SKILLS SOFTWARE FOR ADULT BASIC EDUCATION

There is an ever increasing amount of software on the market today that is purported to be applicable to the basic skill area of adult basic education (ABE). Unfortunately, not all of it is good quality software and not all of it is adult.

Although today's software is much improved over that available just a short time ago, some of it still suffers from problems in programming, program content, or both. The fact is that most good programmers are not educators and most good educators are not programmers. As a result, many programs are extremely limited in scope and often do not pay much heed to the learning process-cognitive development, educational psychology, and adaptive instruction. At the same time, many of these programs certainly do not take full advantage of the unique and powerful capabilities of the microcomputer. Also, because of the high costs associated with the development of good software programs, many of the programs in the basic skills area, while appropriate for adults in content and presentation, were clearly developed for children in terms of graphics, commentary, and responses, but are being marketed as ABE software.

So where to start? How do we know which software to buy? To help answer these questions, I will briefly outline the three major modes of computer assisted instruction (CAI) used with microcomputers.

MODES OF CAI

1. Drill and practice programs are designed to build skills and provide students with practice in those skills until either they or the instructor feel that at least minimal proficiencies have been met. The drill and practice mode generally assumes previous study in the particular skills area. While not all drill and practice programs are structured the same way, most present some type of feedback to the student. The best drill and practice programs usually allow the student to choose the number and level of difficulty of the questions and provide a chance to repeat sections when extra practice is needed.

2. Tutorial instruction generally presents the students with new material, provides questions to measure how much of the new material the student has mastered and based on this evaluation provides remediation or skips over to new more difficult material. The best tutorials assume no previous knowledge of the material and carefully guide the student through all the steps required to understand the concept. In addition, a well developed tutorial will go beyond the usual "Right", "Wrong", or "Please Try Again" feedback by providing the student with an explanation of why a particular response is incorrect.

3. Simulations present the student with a real-life or idealized situation. The complex relationships among the variables that influence the situation must be interpreted by the student and the final outcome of the situation is determined by the actions and decisions which he or she make during the course of the program. Because of the difficulty in programming, there are few good simulations available as yet.

Well, that's a beginning. Now we know what type of program we're looking for. But just how do we go about evaluating it? We must first develop guidelines as to just what a good CAI Program should include. Not surprisingly, the general features of program design are very similar to the guidelines for developing competency based instruction (CBI) programs that are presently used in many of our vocational schools. The basis for CBI is the ability to adapt the educational process to meet the needs of the individual. A well developed CAI Program should reflect this same adaptability and include the following general features.

GUIDELINES FOR CBI PROGRAM DESIGN

1. The student should have as much control as possible over the sequence of the instructional program. The sequence of learning should include options which allow for review of previously presented material; for decisions about the type, level of difficulty and number of problems or exercises to be completed; and the ability to skip over material and choose the shortest routes of exit from the program possible while still meeting all the objectives of the lesson.

2. The system of instruction should be individualized and adaptive to the needs of the student in terms of the amount of time and the amount of material that is most appropriate to their unique learning abilities and styles.

3. As in CBI, programs should be broken down into modules which are again structured into flowchart format forming the complete program. This type of organization provides for the development of skills not previously mastered and the ability to skip over modules of instruction in which the student is already competent.

4. The student should be informed of that which he is not able to do in terms of performance objectives and all learning activities should be developed with mastery of these objectives in mind.

5. The evaluation of student progress, as in CBI, must be measured in terms of mastery of the performance objectives. If such evaluation indicates deficiences, the student should be channeled into remedial activities. On the other hand, if such evaluation indicates mastery, new material should be provided. The best programs include pre-tests to correctly place the student within the program and present material most apprpriate to indicated need.

6. Programs should be, if possible, multi-sensory in their presentation and take full advantage of the machine's unique capabilities.

7. In addition to the structural considerations, certain human factors should be considered in program design. Programs intended for the adult should be written for the adult. They must be written with a positive attitude toward the subject matter; put the learner "in charge" of the program; be

accurate in terms of factual presentation and use of grammar to hold the students' trust; be clear in their instructions as to what is expected and how it should be done to avoid frustration; keep the student involved; and be written with presentation times that don't fatigue the learner.

8. Programs should provide clearly written support materials and documentation.

Even if a software program follows the guidelines for general program design to the letter, the specifics of the presentation are also very important. Here are a few of the characteristics of a program that can make or break it as a successful educational experience.

PRESENTATION OF TEXT AND GRAPHICS

1. Is the software free from programming errors? These can range from grammatical errors to errors in execution of the program. Good programs contain no errors.

2. How does the program present text material? The perceptual impact is an important consideration. Screens should be attractively formatted and not visually overwhelming. A good rule of thumb is that you should never have more than 50% of the screen filled with text at any one time. Any more than that produces viewer frustration because it is hard to read.

3. Does the program use graphics to box, underline, or reverse important textual materials. This can break up the monotony of screens full of text.

4. If graphics or animation are used, are they used appropriately? In some programs, graphics seem to be used only for the sake of using them. Are they necessary? If they are not, they may be nothing more than a distraction from the real intent of the program.

INSTRUCTIONS, EXAMPLES, AND PROGRAM CONTROL

1. Are clear instructions for the operation of the program made available to the user whenever they are needed? Programs without clear instructions often become frustrating as the student must guess what to do in order to continue the program. The user should also be given the option of skipping instructions if they are not needed.

2. Are students provided with examples as to how responses or response choices are to be inputted? The student should not be forced into a trial and error method of completing the task before him.

3. Dos the program limit the number of incorrect responses for a particular question? Programs that require a correct answer before going on to the next question may be particularly frustrating if the question requires a typed response in the "fill-in-the-blank" format. After a limited number of incorrect responses, the program should cycle to the next question or the next appropriate frame.

4. Does the program provide the user with control over the length of time a particular frame is on the screen? The student should be given control over continuing to the next frame where appropriate.

5. Is a menu provided? The student should be given the opportunity to choose from a variety of lessons within a program or activities within a lesson. Menus allow the students to choose topics in their particular interest or have some input as to the sequence of lesson material. One of the menu choices should be to end the session.

INSTRUCTIONAL DIALOG

1. How does the program present the instruction? Some programs turn the microcomputer into nothing more than an electronic textbook. Good programs use the unique capabilities of the computer such as erasing, rewriting, flashing or animation to "show" key concepts rather than to simply "tell" about them.

2. Are the lessons interactive? Does the program effectively use prompts? Programs must respond to both right and wrong responses on the part of the student. Feedback to incorrect student responses should go beyond a simple "Please Try Again" to a short statement of why that particular response is not appropriate. "Wrong answer" prompts should guide the learner toward the correct answer. Correct answers should also be reinforced through appropriate prompts.

3. Does the program use dialog devices to get and maintain interest? The variation of computer generated responses, humor, pace change, and surprise are very effective in maintaining interest levels over a longer period of time. All lessons in a program should not follow exactly the same format.

4. If typed responses are required to be input by the student, does the program accept keywords or parts of keywords as responses? An error in typing in a response should not be read by the computer as an improper response unless it is a typing test.

5. Does the program report student performance periodically during the lesson and at the end of the session? This information will help guide the student toward the appropriate choice of the next session.

6. Is the language level appropriate for the adult? Adults do not want to be "talked down to". Lesson material, responses, and prompts should be written for adults, not children.

CONCLUSION

The guidelines and specifics you just read should provide you with the basics for developing your own system of evaluation and an evaluation checklist. Unfortunately, they do assume you have access to the software. If you do not, don't forget the value of "word of mouth", discussions with other users and the published evaluations in the many microcomputer magazines in print today. One word of caution here though, different reviewers may have different goals than yo do. Only you know what will work best in your ABE classroom.

RESOURCES

Calswell R.M., Guidelines for Developing Basic Skills Instructional Materials for Use with Microcomputer Technology. Educational Technology, October 1980.

Slattery T., Human Factors Consideration in Course Authoring. IBM CBT Newsletter #23, August 1980.

Alexander W.J. The problem of Software. VOC ED, April 1982

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17/21/82

North Central Technical Institute
Lois Gilliland, Career Development Supervisor
July 12, 1982

A Microcomputer Project in Basic Skills

During the Spring of 1981 a project was implemented at North Central Technical Institute (NCTI) to use microcomputer assisted instruction of the basic skills in reading, mathematics, English, science, social studies, and career development. The microcomputers were used as a supplement to the already established individualized instructional curriculum which was used with adults in the Goal Oriented Adult Learning (GOAL) program.

Description of the Project

The goals of the project were to compare and evaluate microcomputer hardware and software. The microcomputers were compared for ease of use, cost effectiveness, software availability, durability, dependability, and portability of equipment. The software was evaluated for directions, educational sequence, ease of use, dependability, quality of graphics, documentation, appropriateness for adults and student reactions.

Hardware purchased included the following:

3 Apple Computers 48K
2 Atari Computers 32K & 40K
3 Commodore PET 4016, 32K
3 Sanyo Monitors
1 Epson Printer
1 - 825 Atari Printer
3 Apple Disk Drives
1 Atari Recorder
2 Atari Disk Drives
3 Cassette Recorders
2 Sony Televisions

A variety of software was purchased. More quality software was available in mathematics and reading. There were great differences in sophistications and dependability in software programs.

Instructional programs included pre-tests and post tests, classroom management systems, drill instruction, and/or systems for extra help. Instructional methodologies included fill in the blank, multiple choice, and typing in the proper answer. Some programs included speed adjustments and provisions for printing worksheets to go with the computer lessons. An annotated bibliography has been prepared to describe this software and its evaluation.

Evaluation forms were developed for both students and instructors. Students evaluated their experience with the microcomputer instruction while instructors evaluated the quality of software. Records were kept pertaining to amount of use of specific software.

Findings of the Project

After approximately eighteen months of using computer assisted instruction, the following findings have been noted:

10. It is advisable to have at least a one day inservice for instructional staff. Often the hardware vendor is willing to provide inservice or use of the hardware. It is not necessary for instructors to learn programming to implement computer assisted instruction

Plans for the Future

Use of the microcomputers will be continued in the GOAL program at NCTI. New and expanded activities will include the following:

1. Commercial software will continue to be evaluated. An annotated bibliography will be prepared for software purchased.
2. Statistics on GOAL students, budgets, and growth projections will be placed on Visicalc or other suitable programs.
3. A collection of free public domain software will be developed to be exchanged with others who are interested.
4. Dissemination activities will be continued.
5. Use of the microcomputers will be extended to the Antigo Campus and the Menominee Indian Reservation.
6. Study and evaluation of new hardware and peripheral attachments will continue.

Services Available from the Project

If you wish assistance in starting your computer assisted instruction, contact: Lois Gilliland, Career Development Supervisor, North Central Technical Institute, 1000 Schofield Avenue, Wausau, WI 54401. Services available include the following:

1. Information needed to start CAI for basic skills.
2. Staff is available for conference and inservice presentations.
3. An annotated bibliography of software is available.
4. Exchange or copying of public domain software.

1. The microcomputers are easy to use and enjoyed by both students and instructors.

2. The hardware has been dependable and few problems have been experienced.

3. It is very effective to include the microcomputer instruction as a supplement to individualized instruction. The computers have been placed in the instructional area instead of in a separate lab setting. This has eliminated the need for a separate aide to monitor computers in the lab and has insured integration with regular curriculum.

4. Choice of hardware depends on ways the computer is to be used and price. The following are characteristics of the hardware:

    a. Atari is strong in graphics and sound. Instructors found it easier to program with Atari. Memory can be expanded with additional modules. Most educational software will run with 32K. There are many wires and modules which must be attached which can be cumbersome. Peripheral attachments must be placed a foot away from the keyboard, or equipment will overheat.

    b. The Apple has the most software available at the present time. Memory can be expanded by additional chips. It has three parts which may make it less easy to transport than the PET. The price is comparable with Atari but greater than the PET. Most software will run on 48K or less.

    c. The Commodore Company has had a special in which three computers could be purchased for the price of two which makes it economical. The Commodore has much more free public domain software available for it. The recorders which are used with the PET in the project are considerably slower in loading than the diskette. Memory can be expanded by additional chips. Most educational software will run on 32K.

5. Use of the microcomputer is very cost effective after initial purchase. It can perform many of the drill and practice functions which take much instructor time with individualized instruction.

6. Software is often difficult to obtain on preview.

7. There are bugs in many software programs. Most vendors have an 800 number which can be called for technical assistance. Most vendors are also very accommodating in replacing these diskettes where bugs are found.

8. Quality of software, in most cases, is directly related to cost.

9. Students especially like the computer assisted instruction due to the immediate feedback. Care must be taken that graphics or other feedback is not too juvenile for adults.

BUSINESS DATA PROCESSING

[redacted] Business Computer and Console Operation 14.0201

The business computer and console operation program consists of learning activities which include a combination of courses and practical experiences concerned with preparing individuals to operate electronic data processing computers. Instruction in the program includes the review of program instructions, determination of procedures for a specific run, readying equipment for operation, and manipulation and monitoring of controls during operation. Additional instruction includes troubleshooting, all types of on- and off-line operations, and operating other specialized equipment for transmitting and receiving data.

Training received in this program could be used as a basis for further training at a community college. Articulation between the secondary and post secondary programs is recommended.

Students should be encouraged by counselors and others to choose electives from related business education courses such as Business Organization and Management, Business Communications, Consumer Economics, and Business Law.

SUGGESTED VOCATIONAL PROGRAM SEQUENCE

12th Grade--SKILL DEVELOPMENT

Cooperative Office Occupations
Computer and Console Operations

11th Grade--SKILL DEVELOPMENT

Computer Programming I

10th Grade--ORIENTATION

Accounting I
Computers in Vocational Education

9th Grade--EXPLORATION/ORIENTATION

Typing I/Keyboarding I
Orientation to Business, Marketing and Management Occupations

[redacted] Business Data Programming 14.0203

This program prepares individuals to convert problems into detailed flow charts; code into computer language; test, monitor, debug, document, and maintain computer programs; and design programs for specific uses and machines. Included in this instruction are classroom and/or actual business experiences in the following areas: converting detailed, logical flow charts to language processable by computer; devising sample input data to provide testing of program adequacy; observing or operating a computer to test a coded program using actual or sample input data; correcting program errors by such methods as altering program steps and sequence; preparing written instructions (run book) to guide operating personnel during production runs; analyzing, revising, and rewriting programs to increase operating efficiency or to adapt to new requirements; and compiling documentation of program development. Additional instruction may include the operation of specialized equipment to transmit and/or receive electronic data.

Students should be encouraged by counselors and others to choose electives from related business education courses such as Business Organization and Management, Business Communications, Consumer Economics, and Business Law.

SUGGESTED VOCATIONAL PROGRAM SEQUENCE

12th Grade--SKILL DEVELOPMENT

Cooperative Office Occupations
Computer Programming II

11th Grade--SKILL DEVELOPMENT

Accounting II
Computer Programming I

10th Grade--ORIENTATION

Accounting I
Computers in Vocational Education

9th Grade--EXPLORATION/ORIENTATION

Typing I/Keyboarding I
Orientation to Business, Marketing and Management Occupations

ACCOUNTING I

Accounting I includes planned learning experiences that develop initial and basic skills used in systematically computing, classifying, recording, verifying and maintaining numerical data involved in financial and product control records including the paying and receiving of money. Instruction includes information on keeping financial records, summarizing them for convenient interpretation, and analyzing them to identify and advise what should be done. Electronic data processing should be integrated throughout the course where applicable. In addition to stressing basic fundamentals and terminology of accounting, instruction should provide initial understanding of the preparation of budgets and financial reports, operation of related business machines and equipment, and career opportunities in the accounting field. Practice sets with business papers may be used to emphasize actual business records managment.

ACCOUNTING II

Accounting II is a continuation of Accounting I which helps students to develop deeper knowledge of the principles of accounting with more emphasis being placed on financial statements and accounting records. It is a study of previously learned principles as they apply to the more complicated types of business organizations: partnerships, corporations, branches, etc. The students may become familiar with such specialized fields of accounting as cost accounting, tax accounting, payroll accounting, and others. Simulated business conditions may be provided through the use of practice sets. Skills are developed in the entry, retrieval, and statistical analysis of business data using electronic data processing equipment. This course should be thought of as a continuation of the first year of accounting as it provides a technical background for college-bound students who plan a business curriculum as well as those who wish vocational preparation.

COMPUTER AND CONSOLE OPERATIONS

Computer and Console Operations is a skill level, data processing course to develop specialized skills in the operation of electronic data processing computers. Course content includes operations/job control language, establishing procedures for specific computer runs, readying equipment for operation, manipulating and monitoring controls during operation, troubleshooting, and other general concepts related to on and off-line operations.

Training in this course should follow other courses in the Computer and Console Operations program sequence. This instruction could be used as a foundation for additional training at a community college. Articulation of content between courses in this sequence and between the computer and console operations program and post secondary programs is recommended.

COMPUTER PROGRAMMING I

Computer Programming I is the first year of a two year skill level course in programming for electronic data processing. The principle course objective is to develop student skills in flow charting, problem analysis, conversion of solutions to code language and applying electronic data processing concepts and equipment to business operations. Programming languages used in the business world are taught and students write a variety of programs to develop language and application skills. Instruction in data base management and the growing interrelationship between data processing and word processing should be stressed. Course content is structured such that individual students progress at their own rate.

The course provides two options for students. One option is for students who are preparing for a career in computer operations, computer programming, or other computer science/data processing careers. Students selecting this option will concentrate their studies on computer operation, computer programming, and developing processing systems for business data.

The second option is for students concentrating in accounting. Accounting students will develop programs and utilize data processing systems to solve problems involving business data.

Equipment in the classroom should include microcomputers and/or a mainframe computer system and printer. The equipment should be capable of processing programs in several languages, eg: Basic, COBOL, FORTRAN, Pascal, RPG II, etc. The mainframe should allow several terminals to process programs and data simultaneously. Equipment should be available to provide students with hands-on experiences in computer operation, development of computer programs, compilation of programs, debugging programs, and test-running programs to determine if the system will execute and print out the desired data in the desired format.

COMPUTER PROGRAMMING II

Computer Programming II is the second year of a two-year course in programming for electronic data processing. The principle course objective is to prepare students for the types and complexity of computer programming applications found in the world of work. Course content is planned to broaden language concepts, develop logical thought processes, and develop student skills in advanced flow charting, problem analysis and systems design. Instruction in programming concepts involved in interfacing computers to other high technology devices is essential.

COMPUTERS IN VOCATIONAL EDUCATION

Computers in Vocational Education is an orientation level course a student takes in the vocational education curriculum to develop awareness and understanding of the application of electronic data processing concepts, software, and equipment in relation to occupations in the areas of Agriculture; Business, Marketing and Management; Health; Home Economics; and Industry. This course could build upon computer literacy concepts taught earlier in general education classes and focuses specifically on the use of software packages by persons employed in these five vocational areas.

Students should receive instruction in communicating with the computer, types and functions of peripheral equipment used in the world of work, capabilities of and limitations on what the computer can do, types of data processing equipment currently being used in the world of work, computer logic and flowcharting, names and differences in use of computer languages used in the world of work, the use of computers in decision making, and computer simulation of situations faced by individuals in a variety of occupations. Students should be given the opportunity to view a variety of data processing systems and should have frequent hands-on experiences. Instruction should be given in the use of text editing, accounting/financial, and data base management software. Instruction also should focus on the ethical considerations that arise in using this equipment and gaining access to available data bases.

COOPERATIVE OFFICE OCCUPATIONS

Cooperative Office Occupations is a capstone course designed to assist students in the development of effective business skills and attitudes through practical, advanced instruction in school and on-the-job through cooperative education. Approximately half the school day is spent taking classes at school and the other half in on-the-job training supervised by the teacher-coordinator and designated training sponsor. The related class at school is planned to develop skills and attitudes that are applied on-the-job. A training plan is developed jointly by the teacher-coordinator, training sponsor and student that identifies training to be provided. Training in the related class at school focuses upon the student's vocational program from the clusters of Accounting, Business Data Processing, Information Specialist, or Word Processing and Administrative Support, with additional assignments based upon areas where on-the-job performance indicates a need. Related instruction also includes applying for a job, occupational survival skills, essential character traits, and basic work relations.

DATA ENTRY EQUIPMENT OPERATIONS I

Data Entry Equipment Operations I is the first year of a two year skill level course in entering data into electronic data processing systems. The course is planned to improve speed and accuracy of students' keyboarding skills on keypunch or special-purpose key entry devices. These devices convert source documents to machine input media for electronic data processing. Additional course content focuses on careers in data entry equipment operation, and develops student skills in verifying and correcting data and monitoring equipment during operation. Course content and skill training are structured such that individual students progress at their own rate. Students should be given frequent opportunity to examine and interact with data processing systems. Students should have hands-on experiences with a variety of data entry devices including both microcomputers (or other stand alone devices) and terminals connected to mini or main-frame computers.

DATA ENTRY EQUIPMENT OPERATIONS II

Data Entry Equipment Operations II is the second year of a two year skill level course in entering data into electronic data processing systems. In addition to continuing the training begun during the first year, students should become familiar with data storage and retrieval, the developing interrelationship between data processing and word processing, and most frequently used expressions in computer languages used in the world of work.

ORIENTATION TO BUSINESS, MARKETING AND MANAGEMENT OCCUPATIONS

Orientation to Business, Marketing and Management Occupations is a comprehensive orientation level course involving a combination of classroom, laboratory, and community-based experiences planned to prepare students with an awareness, understanding, and appreciation of careers and career training available in the field of business, marketing and management. Course content assists students in making a tentative career choice through further development of self-concept and matching personal abilities to those required for employment. In-depth information into business, marketing and management careers; job and educational opportunities; and educational and attitudinal requirements is provided. Instructional units may include: orientation to the world of work; the role of men and women in today's society; and relationships as related to personal fulfillment and employment success, such as employer/employee relations, applying for work, personal grooming, and desirable work habits. In addition, basic information and hands-on experience applicable to Accounting, Administrative Support, Information Specialist, Business Data Processing, Marketing and Word Processing careers are included.

In the business, marketing and management cluster, students are exposed to activities that facilitate the flow of goods and services from the producer to the consumer or user. Marketing functions that are taught include warehousing, purchasing, risk taking, standardization/grading, transporting, promoting, financing, and researching. Students also are exposed to management functions and the facilitating function of an office.

Students will be assisted in the decision of which area of employment best suits them through the use of films, field trips, guest speakers, and other activities. Community-based experiences involving actual participation in the type of work done by persons currently employed in the field may also be included.

TYPING I/KEYBOARDING I

Typing I/Keyboarding I is a course planned to develop basic skills in keyboarding techniques for typewriter style keyboards and ten-key numeric keypads found on a variety of office equipment (including microcomputers and terminals). Major emphasis is placed on keyboarding technique, proofreading, and correcting errors. Secondary emphasis is placed on speed and formatting. Production of copies that meet business standards also is stressed.

BUSINESS PROGRAMS

1. Lease/Buy Analysis
2. Critical Path Analysis (will be 2 programs)
3. Depreciation
    - -Sum of the years digits
    - -Double declining balance
    - -Straight Line
    - -Cross over point
4. Effect of FIFO/LIFO choice of federal tax obligation
5. Effect of depreciation choice on federal tax obligation
6. Effect of Incorporation on federal tax obligation
7. Financial Ratios (17)
8. Capital Funding Comparisons
    - -Bonds
    - -Common stock
    - -Preferred stock
9. Mail List
10. Present or Future Value
    - -Lump sum
    - -Annuity
11. Production Costing
12. Inventory Analysis
    - -Reorder point
    - -Projected use
    - -Turnover rate
13. Job Price/Bidding
14. Rate of Return Analysis
15. Equipment Investment Analysis
16. Forecasting
    - -Least squares regression
    - -Moving Average
    - -Exponential smoothing
17. Breakeven analysis
18. Expected value
19. Critical Path Analysis (see item 2 above)
20. General Ledger
21. Accounts Receivable
22. Accounts Payable
23. Payroll
24. Personnel
25. Order-Entry

This software is to be available from the Curriculum Publications Clearinghouse at Western Illinois University, 46 Horrabin Hall, Macomb, IL 61455. The software is public domain (may be duplicated) except for the General Ledger, Accounts Receivable, Accounts Payable, Payroll, and Personnel. This software is available on a cost recovery basis. To call the Clearinghouse use these telephone numbers: 800/322-3905 (in Illinois) or 309/298-1917.

From: Illinois State Board of Education/Department of Adult, Vocational and Technical Education

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INFORMATION FOR BUSINESS EDUCATION INSTRUCTORS
Microcomputer Instruction

As you integrate microcomputers into your vocational curriculum, you will be trying to figure out what software/courseware (computer programs) to use in your classes. One consideration that may help you in this process is to keep in mind a vocational perspective, that is, use equipment as it will be used in business and industry. This means we sould obtain APPLICATION software that will develop, refine, and reinforce skills that will be needed for productive employment. Three types of software packages form a core to use in the development of computer skills. These include data base management, text-editing/word processing; and accounting and statistical packages.

Data Base Managment--using this software package will develop skills in identifying and evaluating information that will be needed for future reference and use; entering, storing, retrieving and updating information; searching, sorting, and printing information in a useful format.

Text-Editing/Word Processing--as more and more communications are prepared, edited, and stored in electronic form (and may be sent as "electronic mail"), use of this type of equipment and software will affect all people and jobs. Students of all vocational programs will need skills related to the storage, retrieval, revision and transmittal of text in electronic form, not just secretarial and clerical students. Formatting documents, development of standardized documents, inserting personalized information into standardized documents, maintaining records or manuals of existing documents and storage locations, procedures for review and purging of out-of-date materials, all this and more can be taught using this software.

Accounting and Statistical Packages--A variety of software packages fall into this category, from integrated accounting packages that store and update all the affected journals by a single entry, to packages such as VISICALC that serves as an electronic worksheet. Packages in this group generally store numeric information required for decision making. The skills to be developed in using these packages include identifying types of information that may be needed for making decisions, recognizing the extent to which one piece of information may affect other information stored in the system, creating a useful format for information so that trends can easily be spotted, using "what if" reasoning to see the possible results of decisions as projected by a computer model of the situation, as well as storing information for later use and printing the information in a useable format.

As you search for application software, computer assisted instruction software (CAI), and simulation software, don't forget to check with the East Central Network for Curriculm Coordination/Illinois Vocational Curriculum Center on the campus of Sangamon State University (E-22), Springfield, IL 62708, phone 217/786-6375 or (in Illinois) 800-252-8533. Another source that may be used is the Curriculum Publications Clearinghouse at Western Illinois University, Horriban Hall, Room 46, Macomb, IL 61455.

To this point in time, the least expensive diskettes that we have been informed about are from Meta Technologies, 2611 Brush Avenue, Euclid, Ohio 33132. Ask for Verbatim Datalife diskettes. The last price quoted was $26.95 per ten diskettes. There is a $3 shipping and handling charge per order. Additional price breaks may be available for large quantities.

Following are points to consider in preparing to teach about microcomputers:

(1) Are your teacher skills ready? Most schools are beginning by encouraging their teachers to become computer literate. Workshops, sponsored by professional organizations, educational service regions, and local schools are common. Teacher training institutions are offering courses on computer literacy and applications of the microcomputer to education. Community colleges are offering courses and seminars. To facilitate computer literacy among teachers and staff development in general, the Department of Adult, Vocational and Technical Education has made available funds in the form of "Quality Assistance Plans." Contact your vocational director or contact the Research and Development Section (217/782-4620) for details.

(2) Do your students have keyboarding skills? There has been a noticable increase in the number of students taking a year or more of typing/keyboarding. There has also been a suggested change of emphasis in the first year course in typing/keyboarding. Rather than stressing speed and formats, students should concentrate on correct touch keyboarding technique. Enclosed in this packet are suggested course descriptions for the data processing sequential programs. Read the descriptions and look at the sequences to see how some content and articulation concerns are addressed.

(3) What content should be emphasized in the high school courses on microcomputers? Recognize that students do not all need to learn how to program computers! Rapid introduction of microcomputers into schools is resulting in duplication of courses at different levels--computer literacy with an emphasis on BASIC programming is showing up in elementary, middle, and senior high schools. Soon after implementing such courses at the high school, curriculum changes will be necessary. The focus for a first course in the vocational education curriculum is on the application of the microcomputer as students will use it in business and industry (including the agricultural industries). For a better idea of the "application" content, see the suggested course description for "Computers in Vocational Education." Courses on computer literacy or math and/or science applications are not vocational in nature and do not receive vocational reimbursement.

(4) If you are establishing a full, sequential program on Computer Programming, or Computer and Console Operations, consider the computer languages that are used in business and industry. Teaching BASIC is not enough. Just because the students can write BASIC programs does not necessarily mean that they have skill in the programming languages that they will need for employment. COBOL and FORTRAN are more commonly used languages.

(5) A consideration to achieve maximum use of microcomputers and software at a lower cost is to use a networking system. Such a system utilizes one microcomputer with disk drives (and generally maximum internal memory, 48K-64K) as the "host" system. The other microcomputers are connected by cables and the network controller to the host. The instructor places a diskette of programs into the host system and then the students at their computers can access the programs using the network. The advantages include (a) only one diskette is necessary, rather than having several copies of each diskette (but don't forget to keep a backup copy), (b) it is much less expensive to purchase a network rather than purchase disk drives for each student computer, (c) all microcomputers can access the same program or alternative programs on the diskette, or tape input could be used at individual student computers, and (d) the network system enables a student to send work to the host computer to be printed by a line printer. In this way, it is not necessary to move the printer to each computer.

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EJ255967                                        ISBE/DAVTE search May 24, 1982
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   PROJECT B.E.A.T.: BUSINESS EDUCATION ALTERNATIVES FOR TEACHING
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THESE FOUR PAGES REPRESENT AN ERIC SEARCH AND LIST BOTH EDUCATIONAL JOURNAL ARTICLES AND EDUCATIONAL DOCUMENTS RELATED TO MICROCOMPUTERS IN VOCATIONAL EDUCATION.

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Computer-Aided Instruction for Administrative Forms

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EJ185849
Another Look at Rehabilitation

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EJ179450
Computer Assisted Learning and Occupational Training

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Tiny Computers Speed Business Decisions

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The Development and Evaluation of a Pilot Computer-Assisted Occupational Guidance Program (Project No. 16033, 17033, 18033) Final Report and Appendixes A-E.

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  FLEXIBILITY FOR VOCATIONAL EDUCATION THROUGH COMPUTER SCHEDULING.

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Mini - Glossary

Authoring Languages - High level languages with one dedicated purpose: to write instructional programs. Fewer and easier commands than languages like BASIC or Pascal. Examples include - Pilot, Tutor, etc.

Bit - A binary digit

Bugs - Problems with computer hardware or software

Byte - A string of eight binary digits, ex: (10011011), used to represent a letter or a number.

Central Processing Unit (CPU) - Also called microprocessor in a microcomputer. This is the heart of the computer which performs calculations, makes comparisons or in short, processes the information.

Computer Assisted Instruction (CAI) - Instruction delivered by computer. May be drill, tutoring, simulation, etc.

Computer Managed Instruction (CMI) - Student management programs for computers. Includes test making, test scoring, grade figuring, student records, etc.

Computer Network - Two or more computers that have the ability to exchange information.

Courseware - Computer programs used for instruction.

Debugging - Fixing problems with computer hardware or software.

Disk Drive - A peripheral device using floppy disk for storage and retrieval of programs and or data.

Documentation - The instructions for a piece of hardware or software.

Floppy Disk - A mass, external storage device made from a thin, circular piece of magnetic material, capacities range from 100K to 500K kilo bytes

Graphics Tablet or Pad - Whatever is drawn or traced on one of these tablets using a stylus or drawing arm will appear on the display screen and can be stored by the computer for later recall or modification.

Hardware - Any piece of computer equipment.

Inputs - Devices that send information or commands to the microprocessor. Examples include: Keyboards, joysticks or game buttons, graphics tablets, speech recognizers, etc.

K - Symbol representing kilobytes, actually one K equals 1024 bytes.

Languages - A set of commands that can be used to write computer programs. The central processing unit works with binary code language (e.g. 00110101) and higher level languages have commands that represent a group of binary instructions. Examples of higher level languages include: BASIC, Pascal, Fortran, Smalltalk and Logo.

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Light Pen - A stylus connected to the computer with an electrical cord which can detect light on a television type screen and send a signal to the computer. It can be used to make choices from a display on the screen by touching the one you want.

Magnetic Media - Tapes, floppy disks or hard disks made of plastic and covered with a magnetic substance. Signals can be stored on the magnetic surface and the computer can read the signals later, as needed. This is the most common type of media for mass storage.

Memory - Information or instructions are stored in memory.

Operating Systems - The command set used by a computer to control its peripheral devices and the flow of information. Most microcomputer manufactures have their own type of media for mass storage.

Output - Ways in which the computer can give the results of its work e.g., displayed on television screen, printed out (hardcopy) or speech synthesis.

Random Access Memory (RAM) - Memory chips inside the microcomputer that can temporarily store information, be erased and then store something else. Also called the workspace memory.

Read Only Memory (ROM) - Memory chips inside the microcomputer that permanently store information needed by the microprocessor such as a language or graphics instructions.

Service Contract - An extended warranty. Computer repair insurance. Cost ranges from 10 to 15 percent of original hardware cost.

Software - All types of computer programs or the instructions needed by the computer to carry out a given task.

Videodisk - A plastic disk that stores many more times the information of a magnetic disk. These are scanned by a tiny laser beam so the surface does not wear out. Already used for mass memory storage for microcomputers in research projects and will be used extensively in the near future.

Microcomputers in Education:

A Nontechnical Guide to Instructional and School Management Applications

by

Lee Marvin Joiner, George Vensel,
Jay D. Ross and Burton J. Silverstein

Written by and for educators, this book is the first to describe what microcomputers are all about in understandable, non-technical language. **MICROCOMPUTERS IN EDUCATION** gives educators a look at what's been accomplished with microcomputers for schools, both for meeting management as well as instructional needs. The book raises stimulating issues, takes a hard look at the problems and limitations of microcomputers in the schools, and provides the reader with detailed information about venders, organizations, publications, and the state of the art.

The first chapter introduces the reader to microcomputer concepts, looking at micros from the standpoint of their probable impact on curriculum, instruction, and the teaching profession. In chapter two, they address the question of how to immediately begin building staff skills in microcomputing. Cost saving applications, how to insure the effective adoption of microcomputers, and computer literacy are some of the major themes.

The third chapter explains how a microcomputer center was organized in a rural school and what was learned about staffing, teacher and student involvement, and how micros can help build school-community ties. The fourth chapter focuses on planning a system, evaluating courseware, and questions concerning what hardware to choose.

Chapters five and six are about classroom applications and special education. The authors have described a number of interesting micro projects throughout the country and have also included a major section on the newest and perhaps most important breakthrough in instructional technology: computer assisted video.

Chapter seven on micro assisted administration looks at financial accounting and reporting systems that can save schools money. Testing, word processing, scheduling, inventory control, deriving meaning from data, optimal bus routing, and other micro applications that free administrators from time consuming and burdensome chores are discussed. In chapter eight attention is given to new management information systems, what they can and can't do for school organizations and administrations. Much of this material was drawn from what business leaders, already well ahead of educators in computer applications, have learned.

The last chapter, "Computer Confrontation," looks at the struggle that is taking place between the vested, large computer interests of network systems and those using locally controlled microcomputing. (ISBN 0-918452-31-7)

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"The educators, agency personnel and administrators I work with every day are excited about microcomputers and wondering how to get started using them. This book is the answer."

Warren Bock, Deputy Div. Dir., MN Dept. of Public Welfare

"As a microcomputer consultant to public schools . . . I've found this book to be the most valuable single source of information. It is a comprehensive presentation of how microcomputers can be used by teachers and administrators and is in understandable language."

Lawrence Schilling, Southeast Illinois College

Cat # 31-7, Hardcover $24.95

Please include $1.50 per order for shipping & handling

LP Learning Publications, Inc., Box 1326, Holmes Beach, Florida 33509

MAKING SENSE OUT OF MICROS

Thinking of buying a microcomputer for your school? In these days of tight money and limited resources, administrators and teachers cannot afford to buy less than the best piece of equipment for their money and needs. When facing the vast array of equipment available on the market, here are some important questions to ask your vendors. They will help you and the sales representatives narrow down your choices:

1. How many groups will use this microcomputer? What different functions must it serve?

Will students be the only users, or will the counselors, teachers and administrators need to use your new microcomputer? Will users learn basic programming, do independent study lessons, record grades, perform word processing duties, develop student schedules, perform bookkeeping chores, and maintain inventory? Will only math classes use the micro, or will science, reading, or career counseling programs be competing for keyboard time? Identify *all* the potential users from independent-study students through district superintendent to be sure the equipment you select will meet their needs.

2. What shape will your computer curriculum take five years from now? Will your new micro still fit in?

Although a computer may meet all your needs over the next two or three years, it may not expand to meet the growing demands of what is bound to be a "computer explosion" in American education. Find out if your new micro can be adapted to larger systems. (Don't be daunted by the current costs of larger systems — prices are dropping at a steady rate and new technology is constantly expanding computer capacity.) You want to avoid limiting your future options too severely by observing false economy in this initial stage.

3. What kinds of service/repair maintenance comes with your micro?

A new microcomputer can provide reliable service under difficult conditions. But during installation and the first few weeks of running a micro, some adjustments by qualified technicians may be necessary. At times a small problem may develop that needs internal correction. Where is a reliable service person available?

While there may be excellent bargains available in larger outlets in metropolitan areas, their service may be too distant for speedy repairs. Consider whether an initial slightly higher price at a local sales/repair outlet may be offset by avoiding the lengthy delays involved in sending your micro out of town for repair. Ask the local outlets if they have in-house technicians and carry-in service. If a computer could be brought into a local shop for repairs and returned in 24 hours, that could be far preferable to a potential two-week delay and the risk of shipping electronic equipment over long distance.

4. What memory capacity do you need?

Computer memory capacity is measured in bytes. A byte is a unit of memory that contains roughly one character (such as letters or numbers). For most educational uses, 64 kilobytes or more is preferable, but 48 kilobytes can meet many educational needs. This area of technology may change rapidly in the next six months to a year. Research current periodicals to find what new companies are offering and watch what happens to price per unit o memory over the next year. Ask if the memory capacity can be expanded by adding on new memory boards.

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Having answered these broad questions, you are now ready to address the real "nuts and bolts" of the system: the hardware.

5. What are the components of a computer? How do I select the "hardware?"

The physical pieces that form a computer, according to Rodnay Zaks (*Your First Computer*, 1980) include:

1. The *CPU* or central processing unit which draws commands from the memory and executes them,
2. The *memory* which stores commands, programs and the data that makes up the programs, and
3. *Input-Output* which lets the computer talk to the operator.

Questions you should determine about the CPU include whether only one person will use the computer at a time, whether several persons will use the same CPU at a time with one control board, or whether several users will require different boards at a time. More complicated uses require more complicated systems, but the added expense may pay off in greater versatility.

When selecting the CPU, there are two major types to consider: 8-bit and 16-bit processors. Sixteen-bit processors have only recently become available. At present they are considerably more expensive, but the prices are expected to fall significantly. They are especially valuable for "number-crunching" chores such as statistical programming, but less advantageous than 8-bit processors for word processing practices. Since they are relatively new, fewer software packages are available, but this should improve in a short time.

Eight-bit processors have already been proven in use; they have been around long enough for a good quantity of software to be available. While they are currently cheaper, the falling prices of 16-bit processors may become more competitive. They are especially good at character manipulation such as occurs in word processing, rather than in statistical applications. One important drawback for future planning, however, may be that they are less easy to expand beyond 64-kilobyte capacity. Discuss with your vendors the possible advantages of 8- versus 16-bit processors for your specific applications.

Memory storage capacity is also important, since administrative systems such as bookkeeping and student records may not fit on smaller microcomputer systems.

Peripheral devices may include an expanded memory system which may come in the form of tape cassettes (limited performance), floppy disks (much more flexible), and hard disks (most expensive, but most flexible). If you choose floppy disks, you should consider at least two disk drives, because that allows you to compare or manipulate files.

(OVER)

The input device is similar to the typewriter keyboard with extra characters. Check keyboard action by personally testing a variety of them, then if possible talk to users who have the system operating in their businesses or schools. Some keyboards are more sensitive to the touch than others. You may want a more sensitive keyboard if administrative staff will use it on a routine basis, while inexperienced students will make fewer mistakes if the keyboard requires more conscious pressure. Ask users about "ruggedness" of the keyboard if students are to be the primary users.

Output devices are usually a cathode ray tube (CRT) display — the familiar television screen — or a hard copy printer. These vary greatly in cost and quality of printout.

Check the CRT display screen for the number of characters that can fit across the screen (80 characters are generally preferable to 40). Does the color tire the eyes easily? Are the letters clear and easy to read? Some component systems can be used with a standard black and white television set (as economy measure) but the resolution is not as good and may be more tiring to the eyes over long periods of use.

When choosing a printer, determine first whether the printout is intended for internal use (classroom or recordkeeping) or external use (formal letters or written reports). Better quality printers that produce typewriter quality letters are more expensive and typically slower, but they may not be needed for a classroom-only computer. In contrast, the dot matrix printer is cheaper, faster, but produces a lower-quality printout. Ask your vendor about supply expenses over a period of time, too.

In less expensive computers, the CPU, memory, and input-output functions may be included in one "card" or printed circuit board. They are less expensive because of this feature, but harder to expand later, if it can be done at all.

Finally, question the speed with which the CPU handles input from more than one source. If two or more input devices are manipulating data, all devices may experience noticeably slower processing times. For administrative functions this may have an impact on cost efficiency. Ask computer operators in the field how well their systems handle multiple users.

* * *

Once you have narrowed your choices down to four or five systems, a final deciding factor may be the software that makes the system do your job. Many forms of software are available. Three important questions you might ask include:

6. Are software packages available for the systems you are considering?

To find the answer to this one, check the magazines available (see accompanying article on page 4 for starters), see your vendors, and ask computer people locally. New packages come out daily.

7. Do you need software-incorporated security?

If students have access to the same computer that administrators use, some system to protect administrative programs and data should be considered. On a physical level, floppy disks could be kept in locked storage. However, for hard disk drives, you will need built-in software security systems such as passwords. Ask your vendors how this can be done in the programs you consider.

8. What software guarantees and maintenance come with your purchase?

Most software applications must be tailored to meet your needs (or your system must be tailored to the software). An ideal situation would be an in-house software technician at your vendor's to help you get started and to answer your questions as they occur. Software can be an expensive portion of your purchase, so be sure that what you choose can really perform your job. Find out who will answer your questions after you have the system running and someone wants to change the system.

Throughout this article we have tried to give you questions that will outline the problems you will encounter in choosing a computer system. Your best sources of advice are a combination of the vendors in your area, others who already have similar systems running, computer courses, magazines, and books. For further information, you might find helpful the paperback by Rodnay Zaks, *Your First Computer: A Guide to Business and Personal Computing* (1980, SYBEX) for $7.95. Your local library will have additional books to help you.

Good luck in your search for the right microcomputer!

When purchasing a computer, ask if there is help with the software that comes with it. For instance, here Doug Davies (Lancaster H.S.), Mark Nelson (CESA 14), Tom Morris (UW-Platteville), and Dianne Berg, (Belmont H.S.) receive instruction from WCIS staff for the new Apple program, Career Scan I. WCIS will run workshops at the request of host schools; this inservice was sponsored by Mark Nelson, of CESA 14, and hosted by Potosi High School.

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Will be published in book form in Spring 1983 by the
Publications Services
Alameda Co. Supt of Schools
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685 A Street
Hayward, CA 94541

COMPUTER MAGAZINES

For information about educational uses of computers, there are several periodicals on the market:

COMPUTING TEACHER $14.50/yr.
c/o Department of Computer & Info. Science
University of Oregon, Eugene, OR, 97403
contains articles on uses, computer literacy, research; thoughtful & interesting; articles with classroom use also (activities, programs)

CLASSROOM COMPUTER NEWS $16/yr.
P.O.Box 226, Cambridge, MA 02138
good blend of current information, articles on uses, getting started, demystifying computers, written at a novice level

EDUCATIONAL COMPUTING $14/yr.
P.O. Box 535, Cupertino, CA 95015
local coverage

ELECTRONIC LEARNING $17/yr.
902 Sylvan Ave., Englewood Cliffs, NJ 07632
thorough coverage of important topics, written for novice users

For general information about computer uses, there are the following periodicals which are written from the standpoint of computer use. They occassionally carry artilces about educational uses or programs. These cover all microcomputers.

CREATIVE COMPUTING $20/yr.
P.O. Box 789-M, Morristown, NJ, 07690
sections on each computer; programs to use; articles on interesting and unusual uses; applications, and programming

PERSONAL COMPUTING $14/yr.
1050 Commonwealth Ave., Boston MA, 02215
articles on games, home uses; programs

POPULAR COMPUTING $15/yr.
70 Main St., Peterborough, NH, 03458
non-technical introduction to computing, published by BYTE

COMPUTER MAGAZINES

Some magazines are written for specific machines. They are a good source of information about software and hardware for that particular computer, and about uses. Some have an educational column or correspondent.

For APPLE, PET, ATARI, OSI:

COMPUTE $20/yr.
Box 5406, Greensborough, NC, 27403
programming, uses, applications, developments

For APPLE:

APPLE FOR THE TEACHER
c/o Ted Perry, San Juan U.S.D.
231 St. Marks Way, Sacramento, CA, 95825

APPLE EDUCATORS NEWSLETTER
c/o Dave Miller, 9525 Lucerne
Ventura, CA, 93003

PEELINGS-2 $15/yr.
c/o Dr. Merchant, A.P.P.L.E.
304 Main Ave. S., Suite 300B, Renton, WA, 98055

SOFTTALK (free, send Apple serial #)
11021 Magnolia Blvd., N. Hollywood, CA, 91601

For PET:

MIDNIGHT SOFTWARE GAZETTE (send S.A.S.E.)
c/o Jim Oldfield, 635 Maple, Mt. Zion, IL, 62549
software reviews (some educational), misc. info.

COMMODORE MAGAZINE $15/yr.
Commodore, 681 Moore Rd., King of Prussia, PA, 19406

TRANSACTOR $12/yr.
Commodore Canada, 3370 Pharmacy Ave.,
Agincourt, Ontario, CANADA, M1W 2K4
good technical information

For TRS-80:

80 US $16/yr.
3838 S. Warner, Tacoma, WA, 98409
software reviews, articles, hardware, programming

80-S $15/yr.
COMPUTER INFORMATION EXCHANGE, Box 158
San Louis Rey, CA, 92068

80-MICROCOMPUTING $18/yr.
Pine St., Peterborough, NH, 03458

The next group of magazines tends to be more technical, and their orientation is more towards S-100 bus and mini-computers, and hardware.

(kilobaud) MICROCOMPUTING $25/yr.
Pine St., Peterborough, NH, 03458
hardware, business applications, programming

BYTE $19/yr.
P.O. Box 590, Martinsville, NJ, 08836
hardware, minis, applications

MICRO
P.O. Box 6502, Chelmsford, MA, 01824
hardware, 6502-based machines; applications

INTERFACE AGE $18/yr.
P.O. Box 1234, Cerritos, CA, 90701
hardware, futuristics, applications

INFOWORLD (newspaper) $18/yr.
530 Litton Ave., Palo Alto, CA, 94301
newspaper on computer industry, hardware

Another source of information is teacher magazines like TEACHER, LEARNING, etc., and the magazines of various national teachers' associations such as MATH TEACHER, CMLEA JOURNAL, etc. Some of the technical associations which frequently publish articles on computers in education are

AEDS JOURNAL
Association for Educational Data Systems (AEDS)
1201-16th St. N.W., Suite 506, Washington, D.C., 20036

EDUCATIONAL TECHNOLOGY
140 Sylvan Ave., Englewood Cliffs, NJ, 07632

HANDS ON!
Technical Education Research Centers,
575 Technology Sq., Cambridge, MA 02139

INSTRUCTIONAL INNOVATOR
Association for Educational Comm. & Tech. (AECT)
1126-16th St. NW, Washington, D.C., 20036

TECHNOLOGICAL HORIZONS IN EDUCATION (THE Journal)
Box 992, Acton, MA, 01720
(free to administrators; request on letterhead)

Users groups and their newsletters (CUE, Apple Core, etc.) are also good sources of information about software, and sources of software reviews. Request the flyer "East Bay Users Groups" for information on meeting locations.

All teachers should join Computer Using Educators (CUE) as the local group which provides information on computer-related activities in the schools and on software through a great newsletter and two conferences per year. Membership is $6/yr. or $10/2 years to:

C.U.E., c/o Don McKell
Independence High School
1776 Education Park Dr.
San Jose, CA, 95133

Will be published in book form
in Spring 1983 by the
Publications Services
Alameda Co. Supt. of Schools Office
685 A Street
Hayward, CA 94541

ALAMEDA COUNTY
SUPERINTENDENT
OF SCHOOLS

ROBERT C. CONEY
SUPERINTENDENT

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ADMINISTRATIVE SERVICES

HARLEY L. SORENSEN
ASSISTANT SUPERINTENDENT
INSTRUCTIONAL SERVICES

USES OF MICROCOMPUTERS IN SCHOOLS

by
Glenn Fisher
School Computer Specialist

Microcomputers are being bought in increasing numbers by teachers and schools for use in the classroom. What can these machines do that makes them so attractive? What are some of their possible uses in classrooms?

Microcomputers are attractive because they offer large computing power in a small, easily transportable package which gives the user a feeling of being in control. The user is not subject to mysterious events far away at a computer center, as was the case in the past using terminals connected to time-sharing monster computers. They are also attractive because there is a large amount of SOFTWARE (computer programs) available for educational uses. Many teachers and families now have microcomputers at home, which makes them familiar.

However, the real excitement about microcomputers comes from their impact on children and on teaching. A computer in the classroom is like having an aide for the overburdened teacher. Children are excited about computers and love to use them. Computers, using well-written programs, can be facilitators for remarkable learning in children, and open up new vistas. Let's look at some of the ways computers can be used in a classroom.

COMPUTER USES IN THE CLASSROOM

Drill and practice Students not making regular progress in the classroom often make remarkable gains when using computers, allowing them to keep up, and in some cases, catch up, with their peers.

ADMINISTRATIVE SERVICES DIVISION
224 WEST WINTON AVENUE
HAYWARD, CALIFORNIA 94544
(415) 881-6201

BUSINESS SERVICES DIVISION
384 OCIE WAY
HAYWARD, CALIFORNIA 94541
(415) 881-6840

INSTRUCTIONAL SERVICES DIVISION
685 A STREET
HAYWARD, CALIFORNIA 94541
(415) 881-6208

USES

Tutoring	Well-written computer programs can actually tutor students in a subject, responding to their ability and providing instruction when necessary. The computer can actually become a teacher, although it is limited by the choices written in the program.
Simulations	In a game format, students get a chance to experiment with 'models' of the real world, and see results quickly. They can run a nuclear power plant, discover the effects of advertising on sales, operate a water system, develop strategies of fighting fires or marketing a product quickly and without threat of harm to themselves or others.
Problem Solving	Computers can be used to assist in problems requiring large and complex calculations, or those where presentation of information in graphic form is helpful. They also allow changes to be made easily, and quickly display the results of any changes.
Demonstrations	Computer graphics can assist in demonstrating difficult concepts or those where animation is helpful; it is particularly useful in subjects such as geometry and sciences.
Programming	More and more jobs require some ability to understand and use computers. Programming gives students a clear idea of the limitations of computers. It is also a problem-solving activity which builds logic skills and encourages clear thinking and expression.
Games	A computer remembers the rules and only allows correct moves, allowing students to spend their energy learning strategies. Games are motivating and entertaining, and with proper selection, can be related to classroom objectives.
Word Processing	This is a useful employment skill, and has been helpful to students with physical problems with writing. Some teachers have successfully used word processing to get non-writers writing, because it is so easy to make changes and corrections.

MANAGEMENT USES OF COMPUTERS

Testing	Students can take a test, have it graded, and have statistical and diagnostic information available for the teacher.
Record keeping	Computers can quickly do many of the tedious calculations involved in record keeping, saving teacher time. They can keep track of student placement and progress, and have been used for keeping track of competencies and graduation requirements. The computer can rapidly search through records and print out students who have not completed assignments, calculate and print grades, and other such tasks.
Business management	School management tasks, such as budgeting, inventory, etc., can easily be maintained on the computer. Mailing lists can be kept up to date without having to retype entire lists.
Word processing	Schools (and teachers) do a large amount of report and letter writing; the computer can easily and quickly prepare documents and print form letters.

Management uses have an effect on the classroom, because they allow a teacher to spend more time teaching and less on management tasks.

This document was prepared using a word processor program (Apple PIE) on an Apple computer.
6/81

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COMPUTER LITERACY

There have been several projects which have produced computer literacy material. Most of this material is for sale at nominal prices. Besides the addresses, a brief description of the intent and grade levels of the projects are given so you can contact the ones which best fit your needs. If you order materials from any of these sources, please share your opinion of them with CUE or the Computer Specialist.

ADDRESS GRADE LEVEL

PRESCOTT COMPUTER LITERACY PROJECT 9-12
Mr. Harry Dahlberg
Prescott U.S.D.RG
P.O. Box 1231
Prescott AZ 86302
A set of computers are moved from school to school for the literacy project, materials are available.

COMPUTER LITERACY 9
Dave Wooly
Alma High School
P.O. Box 329
Alma, AR 72921
Includes computer languages, history, hardawre, and effects on society.

Elem Math/ Computer/Career Ed. (elem)
Joy Van Meter
Cherry Dr. Elem. School
11500 Cherry Dr.
Thornton, CO 80233
Awareness of computer uses, social implications and career possibilities; improve math skills and develop programming ability.

CAI MODEL PROGRAM 7-9
Richard Kurtzman
Cloonan Middle School
11 West North St.
Stamford, CT 06902
Computer lit. for students and teachers.

CUES (COMP. UTILIZED IN ELEM SCH) 5-6
Lewis Picone
Orange Board of Education
Orange, CT 06477
Comp. lit. for students & teachers, with math component.

Tower Hill School 5-8
Nancy Minnich
2813 W. 17th St.
Wilmington, DE 19806
Library-based literacy and programming.

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COMPUTERONICS 6-7
Pristen Bird
Gifted Child Project
4115 Canal St.
Tallahassee, FL 32301

Thinking & problem-solving skills integrated with literacy & programming for gifted students. Materials available.

COMPUTER LITERACY 9-12
Donald Teel
Coweta County School System
P.O. Box 280
Newman, GA 30263

Comp. lit. in voc. ed., business ed., and math.

CUMBERLAND ELEM SCHOOL PROJECT 5-6
Bob Foerster
Cumberland Elem School
West Lafayette, IN 47906

Computer applications and problem solving for gifted students.

LIVING & LEARNING WITH COMPUTERS 7
Nancy Miller
Clinton Prarie Jr. Hi.
Frankfort, IN 46041

9 week comp. lit. course.

Penn-Harris-Madison Schools 6-9
Richard Hardt
P.O. Box 302
Osceola, IN 46561

Comp. lit. in middle schools, software for elementary schools, and programming in high schools.

Jefferson Parish school Bd. 6-9
Dave Boudreaux
519 Huey P. Long Ave.
Gretna, LA 70053

Comp. lit. and programming for middle school gifted students.

PROJECT SOAR 4-7
Rachelle Carson
The Asa Adams School
Orono, ME 04473

Enrichment and motivation for gifted through computer literacy and programmming.

Montgomery County Public Schools K-12
Lois Martin
850 Hungerford Dr.
Rockville, MD 20850

K-12 computer literacy projects.

MICROCOMPUTER EDUCATION ?
Ed Rykowski
940 N. Jefferson
Springfield, MO 65802
Computer literacy through teacher training and curriculum materials.

CLAMS (COMP'IZED LANG & MATH SYST. COURSE
John Lee 6-12
St. Ignatius Elem. School
St. Ignatius, MT 59865
Computer lit. for 6-12 grades.

COMPUTER AGE CURRICULUM 9-12
Paul Stengel
Custer County High School
Miles City, MT 59301
One semester computer course for high school including programming.

COMPUTER PROGRAMMING CURRIC. 7-12
Dan Waldron
Bridger High School
Bridger, MT 59014
Program to select computer skills to be taught at each grade level; also to develop a resource guide of skills.

MICROS IN THE HIGH SCHOOL 9-12
TOny Tognetti
Stevensville High School
Stevensville, MT 59370
Computer literacy project including consumer awareness of computers; focus on math and science.

COMPUTER AWARENESS PROJECT 3-5
Peter Hutchins
Cornish, NH 03746
Computer literacy project.

Winnacunnet High School 9-12
Bruce Carrier
Alumni Dr.
Hampton, NH 03842
One semester computer literacy for freshmen, including programming, career awareness, history, etc. One semester course on programming for juniors and seniors.

COMPUTERS-IN-SCHOOLS PROJECT K-12
Michael Tempel
New York Academy of Sciences
2 East 63rd St.
New York, NY 10021
Project to introduce computers and computer literacy into schools.

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Donovan School 2-5
Al Galante
Reed St.
Randolph, MA 02368
Computer lit. program for gifted.

Lexington Public Schools K-12
Frank DiGiammarino/Beth Lowd
1557 Massachusetts Ave.
Lexington, MA 02173
Traveling computers; in jr. hi. for programming, math instruction, and computer literacy; instructional uses at elem. and sr. hi.

PROJECT LOGIC ?
Clark Adams
Hampshire Ed. Collaborative
58 Pleasant St.
North Hampton, MA 01060
Program to put computers in schools includes a computer literacy segment.

West Elementary School 4-9
Charlotte Lynch
Beacon St.
Andover, MA 01810
Comp. lit. and programming.

Weston High School 9-12
Beverly Brown
444 Wellesey St.
Weston, MA 02193
One-semester computer literacy course including programming, history, career applications, etc. Algebra I is a prerequisite (that's when the students are introduced to computers).

Central Middle School 9-12
Bee Green
650 Church St.
Plymouth, MI 48170
Computer literacy program in local high schools.

ROSEMOUNT COMPUTER LIT. PROJECT K-12
Lee Droegmueller
School District #196
1445 Diamond Path
Rosemount, MN 55068
A K-12 teacher and student literacy project. Materials are (or soon will be) available.

COMPREHENSIVE COMPUTER ED. 9-12
Tom Hartley/Jack Casner
1211 McGee St.
Kansas City, MO 64106
A computer literacy instructional unit, and training for high school teachers.

MICROSEED 4-12
Everett Carr
Herkimer BOCES Planetarium
Herkimer, NY 13350
Circulates 135 computers among schools to promote computer literacy.

PROJECT CHILD K-6
Ernest Codispoti
Timber Pt. Elem. School
Timber Point Rd.
East Islip, NY 11730
Elementary school computer literacy training done by trained high school students.

HENDERSON COUNTY COMPUTER PROJECT 7-12
Benny Hendrix
Box 1700
125 East Allen St.
Hendersonville, NC 28739
Program covering computer awareness, literacy, and the subject areas of math, science, business ed., and programming.

MICROCOMPUTERS IN THE CLASSROOMS 7-12
Joyce Cunningham
Wayne County Schools
301 North herman St.
Goldsboro, NC 27530
Computer literacy, programming, and instruction.

North Clackamas School Dist. k-6
Lynne Gissel
Milwaukie Elem. School
11250 SE 27th Ave.
Milwaukie, OR 97222
Computer literacy, instruction, etc. in the media center.

COMPUTER AWARENESS IN MIDDLE SCHOOLS 6-8
Sam Black
West Chester Schools
320 N. Church St.
West Chester, PA 19380
A computer literacy program.

COMPUTER AWARENESS TRAINING PROJECT 8-12
Peter Cellucci
Wyomissing Area School Dist.
Girad & Evans Ave.
Wyomissing, PA 19610
A computer literacy program.

READING CONSORTIUM COMP. LIT. 7-12
Jan Rhoads
Reading School District
7th & Washington Sts.
Reading, PA 19601
Computer literacy program.

COMP-YOU-TERS FOR S.D. STUDENTS 7-12
Pat Johnson
Watertown School Dist.
Watertown, SD 57201

Computer literacy and instruction in math, science, and social studies.

COMPUTER LITERACY: A NECESSITY FOR SOCIETY
Lee Laws 7-8
Austin Independent School Dist.
1106 Clayton Lane
Austin, TX 78723

Junior high computer literacy program.

Weber County School District K-12
Paul Fawson
1122 Washington Blvd.
Ogden, UT 84404

Computer as a tool; program covers history, hardware, software, use for analysis and problem solving, and computer languages.

COMPUTER AWARENESS & PROGRAMMING K-6
Jeff Taylor
East Montpelier Elem. School
Box 188
East Montelier, VT 05651

Developing computer literacy, career awareness, and programming in curriculum areas.

FUTURIZING THROUGH COMPUTER AWARENESS 5-8
David Webb
Newton Elementary School
South Strafford, VT 05070

Manual to teach programming in all curriculum areas; future applications of computers.

MICROCOMPUTERS:SOMETHING FOR EVERYONE K-8
Leo Ethier
Stamford Elementary School
RFD 1
Stamford, VT

K-8 computer awareness, technology, applications, and some programming.

Fairfax County Public Schools K-12
Marvin Koontz
10700 Page Ave.
Fairfax, VA 22030

Developing a K-12 literacy program, and placing computers in schools.

ADAPTATION OF COMPREHENSIVE 9-12
COMPUTER PROJECT
Roger Myren
Somerset Public Schools
Box 100
Somerset, WI 54025

Computer literacy through computer science classes, stressing programming, history, careers, etc.

COMPUTER LITERACY FEASIBILITY STUDY K-12
Bernard Arenz
Madison Metro School Dist.
545 West Dayton St.
Madison, WI 53703

A study of existing computer literacy projects to find one for adoption; and implementation.

COURSE GOALS IN COMPUTER EDUCATION K-12
Commercial-Educational Distrib. Services
P.O. Box 8723
Portland, OR 97208

This is a book (of over 170 pages) which contains course goals for computer education in the fields of values, problem solving, basic ed., computer systems (hardware), calculators, calculators, software, applications, uses in business & industry, history, computer science, and computer education and careers. It also includes a wealth of other information about using the book and how the information was assembled. The course goals are listed by field, then rated for student level; knowledge, value, or process classification, subject area program goals, career ed. program goals, and other related headings.

Compiled from a publication of the Gutman Library, Harvard Graduate School of Education, by Glenn Fisher, School Computer Specialist, Alameda County Superintendent of Schools Office, 685 A St., Hayward, California 94541.

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Prepared by:
Glenn Fisher
School Computer Specialist

**ALAMEDA COUNTY
SUPERINTENDENT
OF SCHOOLS**

ROBERT C. CONEY
SUPERINTENDENT

GETTING STARTED WITH COMPUTERS

You must be interested, or you wouldn't have picked up this flyer! You'd like to know more about these funny combinations of typewriter keys and t.v.s called microcomputers? You might even want to use one in your classroom?

Great! Like any new machine, you have to learn a few rules about how it works, and the more time you spend, the easier it gets. So how can you spend some time with a computer? You could

- visit a friend who has one
- spend some time at a nearby computer store
- drop in at the Computer Center at the Learning Resource Services, County Superintendent's Office
- rent one for a week or a month
- spend some time in the computer room at the Lawrence Hall of Science

Once you actually have a computer in front of you, take a deep breath, uncurl your fingers and toes, and relax a bit. It didn't bite yet, did it? Actually, there is very little you can do to damage a computer-like drop it. Typing the wrong word or pressing the wrong key does not hurt, damage, or bother a computer (often, just the operator's ego!) Either find a patient person or a very clear book(TRS-80 User's Manual for Level I is one of the best), and slowly go through the first steps of turning it on (do it a few times, the computer won't mind, and you'll find it easier to remember). You may want to load a program and play a familiar game, like Hangman, the first time (it's O.K. to laugh). Or, perhaps you would prefer to have the TV screen filled with your name, or the result of a program written by you- consult your book or friend. But do what is most comfortable for you. You do NOT have to learn how to program (the computer understands a language called BASIC) to use a computer-just how to turn it on and load a program, and that is about as easy as using a tape recorder.

Once you've had a chance to get acquainted with the computer, and your hands don't shake just thinking about it, you might want to try one in your classroom. Of course, like anything else new, you need to do some preparation. Perhaps another teacher in your school or district is using one and can bring in in, or you feel comfortable bringing in a borrowed or rented one. Or, maybe the County Computer Specialist will be bringing in a computer. Besides the computer, you will need a set or rules and a few programs for the kids to use. However, before you use a computer in your class, do take time to get comfortable with one. You'll be a lot happier and a lot more successful if you do!

The great day arrives- and passes. The kids go home estatic- "We had a COMPUTER in our class today" - and you breathe a sigh of relief. It didn't explode, jump up and down, or otherwise embarrass you- and possibly you enjoyed the kid's reaction. Now let's see- how can I get hold of one of those computers for my classroom...

For assistance in any area of microcomputer use, contact:

Glenn Fisher, School Computer Specialist
Alameda County Superintendent of Schools
685 "A" Street
Hayward, CA 94541 (415) 881-6083

GUIDANCE AND COUNSELING

MICROCOMPUTER PROGRAMS

Bonnie L. Simms - Writer

Lyle D. Jensen - Programmer,
Writer

Albright Middle School
1110 S. Villa Avenue
Villa Park, IL 60181

COUNSELEE - ORIENTED PROGRAMS

1. NEW STUDENT ORIENTATION:

A series of initial data questions given to all students new to the district. Basic questions like name, address, etc. are supplemented by additional information-gathering such as: Family situation, previous school attended, favorite subject, previous grades, and school experiences. Directions are explicit to accommodate non-computer-literate students.

2. AGE FOCUS:

A series of 7 questions -- open ended -- regarding present self-image. Used as a basis for further guidance sessions with the student who is having trouble getting in touch with himself and his feelings.

3. COUNSELING:

A series of 12 agree-disagree statements which will reflect a student's values in certain areas. Each question also has a place for open-ended comments to give reasons for each student's answer. Areas covered: failure, cheating, conscience, discipline, peer influence. This program has the feature that answers can be read by no one but counselor, and reading can be done at a later time.

4. I SEE ME:

A series of 19 questions requiring yes or no answers designed to help the counselee gain a better understanding of himself. At the end, a general statement is given, along with results, to the student regarding whether or not further counseling in specific areas is needed. Areas covered include: feeling good about self, personality traits, habits, relationships with others.

5. VALUES SURVEY:

A combination parent-adolescent survey used for parenting classes. 16 values are rated from "very important" to "of no importance" by both parent and child. Each is then asked to give an estimate of the most and least similarly rated values. This survey is then used as a "take-off" for parent-adolescent discussion.

6. CHARACTERISTICS

Identical to values survey, but using "personal characteristics" in place of "values."

7. JOB CHOICES:

A program designed to be used as an interest indicator for a future career day. Students choose careers they are interested in finding out more about from a field of 32. Those with highest interest are represented at career day. Tabulation is recorded at the end. Choices must be pre-listed on paper in order that the numerical tabulation may be correlated.

8. CAREER OUTLOOK:

This program gives the 10-year forecast for 18 careers, listing whether the outlook is good, average, or poor, and stating salaries and educational requirements.

9. CURRICULUMS:

This program is an informational one designed to acquaint 8th graders with the different course requirements of a college preparatory, vocational, and general high school program. This is a refresher listing after classroom presentation of material.

10. WHAT WOULD YOU DO:

A series of forced-choice questions dealing with personality. A tally is kept of how many active, passive, avoidance, dependent and mature answers are given.

11. STUDY SKILLS(Rasputin)

This is the first in a series of programs dealing with how to study. Rasputin involves test taking skills at the 5.0 reading level (ideal for L.D. or slow Jr. Hi. students as well as 5th graders). Future additions will be on finding details, main idea skills, context skills, etc.

COUNSELOR TIME SAVERS

1. EIGHTH GRADE SURVEY:

A survey given to 8th grade students at the end of the year to measure their concepts of their school years at Albright. Questions deal with: relationships to others school subjects, study habits, and decision making. (These 7 questions are a sample of the entire survey.) A response tally and averaging of responses is available at the end.

2. ALBRIGHT:

A survey given to 8th grade students at the end of their last year at Albright. Eight open-ended statements reflecting questions about general changes to be made, subjects liked and disliked, junior high influence on high school choices, tests, and homework. This program has the feature that answers can be read by no one but the counselor, and reading can be done at a later time.

3. SIMS FILE:

A program designed specifically for the counselor or administrator. It has the facility for keeping day-to-day records on students -- for a variety of purposes -- which can later be printed out when needed. Used at Albright for listing contacts of potential truants or students who may enter the court system for one reason or another. This program also has the format to be used for: attendance, grades, college information, etc., merely by changing the data system.

4. WILLOWBROOK GRADE ANALYSIS:

A statistical program computing the percentages of honors and failures, at the freshman level, of last year's graduating class. A program such as this keeps a check on how well the graduates from Albright are achieving in relation to freshmen from the other feeder schools. Also lists individual courses in which students are failing. A print-out is given to the Board of Education.(Good P.R.)

5. FIFTH GRADE SURVEY:

A series of questions involving how well fifth graders (the youngest class in our building) adjusted to the middle school setting. Questions deal with personal, academic, and social-emotional well-being.

6. CALIFORNIA:

A sample of how a commercial test may be put on the computer to facilitate answering and scoring. Instant tabulation makes it a great time saver.

7. ATTENDANCE:

Homeroom attendance register. Could easily be adapted to our whole junior high. Keeps attendance records and allows teacher three options.

1. Read entire list
2. Record for given student
3. Attendance for given day option 2 allows the choice of the entire list or attendance for a given month.

8. GRADE ACCUMULATION:

This program calls up the major subject grades of any junior high student. Gives grades for each quarter. Keeps track of any student with more than one failure in a quarter.

Options:

1. Student record
2. Honor roll
3. Failure list
4. Alphabetical list of grades by subject
5. D & F grade

9. DETENTIONS:

Records all detentions given to our junior high students. Options include getting detentions served.

1. By a given student
2. On a given date
3. From a given teacher

NEW COUNSELEE - ORIENTED PROGRAMS

1. STUDENT INTEREST SURVEY:

60 yes or no questions relating to how he feels about certain situations which might suggest a personality geared to specific job clusters. Graph profile at end in 6 areas then presents possible careers which might fit that trait.

2. MY PLUS AND MINUS QUALITIES

Asks student to assess self and input up to 8 qualities which are:

1. His basic good features
2. His basic limitations
3. Specific things to overcome each limitation listed in 2.

Then two sentences which ask for an instance where he turned someone on and off with his actions.

3. A DESCRIPTION OF ME:

Student evaluation of self lists characteristics of what he is now, what he wants to become and what others need him to be. Print out used in follow-up discussion. Also includes a section on roles in life as related to other people.

4. SELF IMAGE INVENTORY:

Asks student to give one experience in life which was an example of his being one of the words in the presented list. List includes words like a follower. selfish, worried, angry, cooperative, etc. presents 16 words and two follow up questions on knowing self.

5. WHAT DO I VALUE:

Student may enter up to 12 things in each list. Sections include:

1. Things important to you
2. People important to you
3. Ideas important to you

6. SELF-IMPROVEMENT:

Student is asked to input 3 responses to each of 3 questions:

1. How can I improve my outer me
2. How can I improve my mind
3. How can I improve my emotions

7. ADOLESCENT QUESTIONS:

Students are asked 22 questions relating to family harmony and communication. Student answers each question with a scale from 1 - 5 ranging from 1 never to 5 always. Four questions follow which require full sentence responses. These questions bring out feelings about family situations.

8. HOW DO YOU FEEL:

Asks student to finish 10 statements on how he reacts to certain situations involving relating to strangers and communicating with others around him.

9. WORD ASSOCIATION:

Presents student with a word. They are to type in the first word they mentally associate with the word on the screen. Response is timed so student should not hesitate or think to beat the timer.

AN ERIC SEARCH - THE USE OF MICROCOMPUTERS IN COUNSELING AND STUDENT SERVICES

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TYPE 18/3/1-88
18/3/1
EJ261094
  Effective Computer Resource Management: Keeping the Tail from Wagging the
Dog.
  Sampson, James P., Jr.
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creative computing
SOFTWARE PROFILE

Comparative Evaluations of Basic Systems

M. Firebaugh, T. Fossum, P. Sorensen and W. Stone

I. Background and Method

Following the flood of small computer hardware has come a continual stream of Basic language systems. Some of these run under the Digital Research Corporation operating system CP/M for the 8080/Z80 family of personal computers and some are designed for specific personal computers.

We felt it would be instructive for us and valuable to potential computer users to compare several of these systems, measuring such properties as memory requirements, speed, error diagnostics, and quality of documentation. The method used was similar to that used in the comparative evaluation of small computer hardware published previously.[1,2] Software houses were invited to submit their Basic systems for evaluation with the understanding that they could review and comment on a draft version of the results.

Our evaluation results are summarized in the form of three tables. In Table I we present system characteristics, most of which should be available by a careful reading of well-written system documentation. Some characteristics were verified by short test programs. In Table II we present the results of five benchmark programs which were run to measure experimentally memory requirements, speed, and accuracy on each system. Finally, in Table III we present our evaluation of some of the more subjective features of each system, such as the quality of documentation, editing capabilities, and convenience.

We would stress that the purpose of this evaluation is not to rank these systems or to categorize any system as being "good" or "bad." Since individual needs as well as the prices of various Basic systems vary widely, a system appropriate for one application may be entirely inappropriate for another. In designing the benchmark programs we tried to achieve a balance of "typical" applications including sorting, number crunching, string manipulation, and tests of various functions and error responses. While this selection of benchmark programs was arbitrary and reflects our own experience, it probably produces a fairer test than would a single application program. Finally, to compare the present generation of small computer Basic systems to older and present generation minicomputer based systems, we include the results of running the benchmark programs on a Hewlett-Packard 2000 timesharing system and a Digital Equipment PDP-11/45 respectively.

II. Results

A. *Defined System Characteristics*

In Table I we present system characteristics as obtained from the software manuals. Such characteristics are clearly important considerations to users in selecting a software package. We did not list all special features available on each system.

B. *Measured System Characteristics—Benchmark Results*

In Table II we present the results of running our set of five benchmark programs. The CP/M system was implemented and the first four systems tested on an Altair 8800B with 48K of memory. The last six systems were tested, respectively, on a 48K APPLE II, a 32K Commodore PET, a 32K TRS-80, a North Star Horizon, a 128K HP-2000 time sharing system (in single-user mode), and a 64K PDP-11/45 under the RSTS/E system. To make the timing and memory requirement results meaningful. the benchmark programs run on each system were identical with the exception of minor system dependent instruction changes. A listing of the set of benchmark programs is available from the authors upon request. We summarize the function of each program below:

FCNEXR – Function exercising program. This program called system predefined functions including the trig functions, log and exponential functions, square root and power functions, and random number generator. The general algorithm was to repeat the process $y = f(x)$, $x = f^{-1}(y)$ a number of times and compare the final result for x with the initial value of x. This gives some measure of the accuracy of the algorithm used in the function and the inverse function and should detect any significant error in either (unless the error in the function compensates precisely the error in the inverse function). The random number generator was tested by calculating the Nth moment x^N of the random number x and comparing this to the theoretically expected value of 1(N+1) for values of N up to 10. Since the accumulated errors were consistent with round-off

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M. Firebaugh, T. Fossum, P. Sorensen, and W. Stone, University of Wisconsin-Parkside, Kenosha, WI 53141

Work supported in part by the Center for the Application of Computers University of Wisconsin-Parkside, Kenosha, Wisconsin.

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Comparative, cont'd...

TABLE I(a): DEFINED SYSTEM CHARACTERISTICS

System	Version Tested (Date)	List Price	System Memory Requirement	Maximum Symbolic Variable Length (#Significant Characters)	Integer Arithmetic ?	Multi-Statement Functions ?	Function Recursion[1] ?
CBASIC	2.04 (©1978)[2]	$100-140	20K Compiler 17K Runtime	Unlimited (31)	yes	yes	no
MICROSOFT	5.01(7-23-79)	$350	24K	40(40)	yes	no	no
TARBELL	12.14(8-6-79)	$50	24K	23(23)	yes	yes	yes
OPUS	2.3C(©1978)	$99-195	24K	72(72)	no	yes	yes
APPLESOFT II	DOS 3.2 plus (©1979)	$200 (firmware card)	10K ROM or 16K RAM	238(2)	yes	no	no
COMMODORE PET	2001-32N(6-79)	$1200 with hardware	16K	80(2)	yes	no	no
TRS-80	2.3(©1979)	comes with hardware	22K	255(2)	yes	no	no
NORTH STAR	DOS 4.0	comes with hardware	13K	2(2)	no	yes	yes
HP-2000 TS	1976	comes with hardware	28K BASIC complete sys.	2(2)	no	no	no
BASIC-PLUS	RSTS/E V 7.0	comes with RSTS/E sys.	64K for complete operating sys.	30(30)	yes	yes	yes

[1] This feature allows a function to call itself.

[2] The current versions of CBASIC are 2.05 for CRUN2 and 2.03 for CBAS2.

TABLE I(b): DEFINED SYSTEM CHARACTERISTICS - (continued)

System	Multi-Statement Lines?	Line-by Line Syntax Check?	String Arrays ?	Error Message Format	Statement Number Format	Variable Dimension Default	Floating Pt. Mantissa Precision
CBASIC	yes	yes (compile time)	yes (255 char. deep)	2 letter code 37 for compile 51 for runtime	optional - any floating point #	none	14
MICROSOFT	yes	no (only at runtime)	yes (88 char. deep)	full phrase	required 0-65K	11	7 single prec. 16 double prec.
TARBELL	yes	yes	yes	40 short word mnemonics	optional - any alpha numeric string	none	8
OPUS	yes	no	yes	minimal execution error messages	optional - numeric	none	2-55 under program control
APPLESOFT II	yes	no (only at runtime)	yes (256 char. deep)	17 2-3 word messages	required - 0-65K	11	9
COMMODORE PET	yes	no (only at runtime)	yes (255 char. deep)	27 full phrases	required - 0-65K	11	9
TRS-80	yes	no (only at runtime)	yes (255 multi-dimension)	complete sentences	required - 0-65K	10	5.7 single prec. 15.9 double prec.
NORTH STAR	yes	no (only at runtime)	yes	26 2-3 word messages	required - 0-65K	10	8, 10, 12, or 14
HP-2000 TS	no	yes	no	complete sentences	required - numeric	10	6.9
BASIC-PLUS	yes	yes	yes	complete sentences	required - 0-32K	10	6 single prec. 15 double prec.

Comparative, cont'd...

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TABLE I(c): DEFINED SYSTEM CHARACTERISTICS - (continued)

System	Floating Pt. Exponent Range	Floating Pt. Byte Requirements	Statement Renumbering Command?	Nested IF Structure?	Depth of Nested Subroutines	Assembly Language Linkage?	Formatted Output
CBASIC	-64 +63	8 BCD	not applicable	no	20	yes	yes
MICROSOFT	±38	4 binary, 8 double prec.	yes	yes	no limit specified	yes	yes
TARBELL	±99	6 BCD	no (line designators)	yes	no limit specified	yes	yes
OPUS	±63	3-30 BCD	yes	yes (block structure permitted)	no limit specified	yes	yes
APPLESOFT II	±38	5 binary	no	yes	24	yes	no
COMMODORE PET	±33	5 binary	no	yes	no limit specified	yes	no
TRS-80	±38	4 binary, 8 double prec.	yes	yes	no limit specified	yes	yes
NORTH STAR	±62	5 binary	yes	yes	no limit specified	yes	yes
HP-2000 TS	±38	4	yes	no	no limit specified	no	yes
BASIC-PLUS	±38	4 single prec., 8 double prec.	no	yes	no limit specified	no	yes

errors in every case, we conclude there are no obvious problems with the functions supplied with the systems under test.

QSORT — Sorting program. This program generated 300 random numbers and used the Quicksort algorithm[3] to rank them in increasing order.

MATINV — Matrix inverting program. This program used the synthetic elimination algorithm[4] to invert a N x N "Hilbert Matrix" [in which the element $M(I,J)$ is defined as $M(I,J) = 1/(I+J-1)$]. The inverse matrix was then multiplied by the original matrix and the resulting matrix compared to the theoretically expected identity matrix [$Id(I,J) = 1$ for $I = J$; 0 otherwise]. The maximum deviation of the calculated result from the theoretical value for a 5 x 5 Hilbert Matrix is listed as the "Floating Point Accuracy" in Table II. The timing test results are based on the run time required to invert a 10 x 10 matrix.

STRMAN — String manipulating program. This program created a string and exercised some of the string manipulating subroutines, including CHR$, MID$, and concatenation.

ERRTST — Error testing program. This program simulated the most common errors made in Basic language programming and tested the error exit, defaults, and diagnostics. The general categories of errors tested included: dimension errors,

TABLE I(d): DEFINED SYSTEM CHARACTERISTICS - (continued)

System	Max. Number of Array Dimensions	Break Procedure	Number of String Functions	Peek and Poke Commands	Chaining and Common Variables?	Error Trapping?
CBASIC	no limit specified	none	10	yes	yes	on file errors
MICROSOFT	no limit specified	CTRL C	8	yes	yes	yes
TARBELL	no limit specified	CTRL C	15	yes	yes (no common variables)	no
OPUS	no limit specified	CTRL C	6	yes	yes	yes
APPLESOFT II	88	CTRL C	8	yes	yes (no common variables)	yes
COMMODORE PET	3	STOP CTRL C	8	yes	yes (no common variables)	no no
TRS-80	no limit specified	CTRL C Break	9	yes	yes	yes
NORTH STAR	no limit specified	CTRL C	7	yes	yes (no common variables)	yes
HP-2000 TS	2	Break	--	no	yes	yes
BASIC-PLUS	2	Break CTRL C	23	yes	yes core common area	yes

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Comparative, cont'd...

assignment errors, arithmetic errors, function errors, program structure errors, and miscellaneous errors such as exit procedure from a tight loop. Since this program was purely diagnostic, no timing test was run on it.

C. *System Evaluation*

In Table III we present a subjective evaluation of each system based upon our experience in working with it. Most of the characteristics listed in the evaluation summary should be self-explanatory. However, we should comment briefly on the "Transportability of Dialect" category. Here we are concerned with two questions. By outward transportability, we mean "How easy is it to convert programs written under this system to other Basic systems?" By inward transportability, we mean "How easy is it to convert Basic programs written elsewhere to this system?" The answers to both questions clearly depend on what systems are under consideration.

We raise the transportability issue because we believe potential users should be keenly aware of both the advantages and disadvantages of highly-touted "extended features" of various Basic systems. The advantages include the additional power and flexibility which such features provide. The primary disadvantage must be the system-dependent nature of programs incorporating these extended features. Potential users should recognize that the more extended features a given Basic system offers, the more difficult will be the task of converting resulting programs to other Basic operating systems. In general, the closer the Basic system adheres to the new ANSI Minimal Basic standard, the easier the job of transporting programs into and away from the systems will be.

III. Observations and Conclusions

Below we present some observations and conclusions based on the results tabulated above and our experience in working with each system.

Cbasic -- The strengths of this system include its compiler structure and very high precision. As a compiler, it optimizes the use of memory (but not necessarily speed) and is a good system for designing commercial end-user programs. However, since it requires separate processors for editing, compiling, and running, it does not lend itself easily to frequent program changes. This makes program development and debugging inconvenient, although it does have a good set of error messages.

Microsoft — This is an excellent, all-purpose system. Its availability on most hardware systems and adequate customer support have helped make it the standard of the industry. It performed well on all tests but was the most expensive system evaluated.

Tarbell — Several unique features make this interesting system potentially one of the most powerful of those tested. These include flexible I/O features and a line descriptor label format which provides a clear "assembly-language-like" logical structure to programs. The system is also the least expensive of those tested, and the source program is available for modifications and deletions. On the negative side, the documentation was minimal, our system was prone to crashes, and the benchmark programs required the most memory space of any system tested.

Opus -- This system, although technically not a true Basic language, has its roots in Basic. With its well-designed block structure and string labels for logic control, it provides the best capability for implementing well-structure end-user application programs of all the systems tested. Other unique features include no distinction between string and numeric variables, and programmer-controlled precision of up to 55 digits. It is not a good language for beginners, and the error detection and diagnostics have not reached the sophistication of the structured programming concepts. Run time error detection is essentially incomprehensible, which makes debugging long programs difficult. The extended features greatly reduce the transportability of programs written in OPUS. Our test results indicate it was the slowest program in execution. However, it is a powerful language and we agree with its author that it "both challenges and rewards the programmer."

Applesoft II -- This is the extended, floating-point Basic which we ran under DOS Version 3.2 on one of the popular Apple II Plus computers. This version is Microsoft's Basic extended by Apple to include commands for low- and high-resolution graphics, analog game control input, and speaker output. These commands have been incorporated in a very natural way. In general this system is very convenient to use. It performed extremely well in the speed and accuracy tests and about average in program memory requirements. Because of the extensive, well-written documentation and convenient implementation, this system is well suited

TABLE I (e): DEFINED SYSTEM CHARACTERISTICS - (continued)

System	Random Access of Files	Nested Loop Depth	Number of Key Words	Trace Features	Special Features
CBASIC	yes	no limit	92	yes line # option	compiled
MICROSOFT	yes	no limit	80	yes	
TARBELL	yes excellent file commands	no limit	110	none indicated	line descriptors - assembly like flexible I/O facility
OPUS	yes	no limit	94	yes single step option	block structure, multiple precision arithmetic
APPLESOFT II	yes	10 levels	106	yes	color graphics, analog inputs, TTL I/O Ports, Tone generator
COMMODORE PET	theoretically, but bugs remain	10 levels	71	no	real time clock, graphics character set, screen editor
TRS-80	yes	no limit	89	yes	black and white graphics
NORTH STAR	yes	no limit	73	yes	extensive business applications software available
HP-2000 TS	yes	no limit	---	no	excellent diagnostics, extensive system library
BASIC-PLUS	yes	no limit	238	yes	excellent diagnostics, extensive system library

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Comparative, cont'd...

TABLE II: MEASURED SYSTEM CHARACTERISTICS - BENCHMARK RESULTS

System	Program Size - No. of Bytes Before Run (No. of bytes after run)					Program Run Time (sec)				Floating Pt. Accuracy (Matrix Test, N=5)
	FCNEXR	QSORT	MATINV	STRMAN	BMKTST	FCNEXR	QSORT	MATINV	STRMAN	
CBASIC	1339	597	1679	492	4309	695	62	164	106	4 E-9
MICROSOFT	1747 (1862)	1095 (3602)	1613 (10,326)	895 (6831)	6161 (6201)	68	80	90	114	5.9 E-3
TARBELL	2786 (2953)	1966 (5646)	3972 (7572)	1352 (1425)	9268 (9474)	293	103	96	138	2.0 E-3
OPUS	- - - - - - - - - - Not Available - - - - - - - -					1853	319	413	226	5.3 E-3(8 digit accuracy)
APPLESOFT II	1601 (1768)	1081 (4154)	1604 (12,448)	849 (904)	5642 (5746)	62	56	55	63	1.2 E-5
COMMODORE PET	1706 (1902)	1140 (4203)	1792 (12,636)	904 (966)	6075 (6133)	70	68	67	82	1.2 E-5
TRS-80	1668 (1800)	1200 (3600)	1270 (1854)	923 (1024)	Not Available	76	94	92	134	5.9 E-3
NORTH STAR	1790	1057	1792	904	5632	67	46	41	49	1.0 E-3
HP-2000 TS	1670	1240	1398	942	5988	6.5	20	17	70	7.8 E-3
BASIC-PLUS	8192 (8192)	6144 (12,288)	8192 (12,288)	6144 (6144)	Not Available	6	7	9	20	1.4 E-12

for both the beginner and expert interested in serious computing.

Commodore Pet Basic — This language was written by Microsoft for Commodore. It includes therefore, most of the language features which have made Microsoft Basics the industry standard. The performance of this version of Basic is very similar to other Microsoft-generated dialects. Some programs run a little slower, but this is probably due to the fact that Commodore Basic is a real-time interrupt driven language. This aspect is a powerful one since certain interrupt vectors are maintained in volatile RAM memory and may be changed by user software. The most significant feature of this version of Basic is the screen editor which makes changing programs far easier than on many other systems.

TRS-80 Basic - This system was originally developed by Microsoft for the very popular Radio Shack computer. One of the primary advantages of the system is the excellent, nationwide support provided through company owned Radio Shack stores and a majority of the dealerships. New system update diskettes are provided without cost as they appear. The system has a full text editor, easy assembly link-

TABLE III(a): SYSTEM EVALUATION

System	Built-in Function Performance	Error Identification and Diagnostics	Quality of External Documentation		Ease of Editing
			Reference Manual	User's Guide	
CBASIC	Slow execution, high precision	Good, with two letter coded message	good	minimal	none
MICROSOFT	Satisfactory, single precision only	Good, with adequate diagnostics	good	good	very good
TARBELL	Slow execution, approx. 6 digit precision	Some errors undetected, otherwise good error detection, descriptive error messages	fair	minimal	excellent flexibility prone to crash, documentation poor
OPUS	Slow execution, approx. 6 digit precision	Errors detected but not easily identified	good	good	retype line
APPLESOFT II	Satisfactory	Good error detection, appropriate diagnostics	excellent	good	excellent screen editor
COMMODORE PET	Satisfactory	Good detection, adequate diagnostics	good	fair	excellent screen editor
TRS-80	Satisfactory, single precision only	Good, with adequate diagnostics	excellent	good	very good, adequate screen editing, minimal documentation
NORTH STAR	Satisfactory	Good detection, adequate diagnostics	excellent	good	very good line editor
HP-2000 TS	Satisfactory, approx. 6 digit precision	Good error detection, complete diagnostics	excellent	good	retype line
BASIC-PLUS	Fast execution, high precision	Good error detection, complete diagnostics	excellent	good	retype line or use excellent text editor

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TABLE III(b): SYSTEM EVALUATION - (continued)

System	Ease of Code Documentation	Convenience	Transportability of Dialect Outward	Transportability of Dialect Inward
CBASIC	Remarks allowed in source file, flexible statement format	Poor - separate processor for edit, compile, and run	Fair	Good
MICROSOFT	Standard REM statements	Excellent	Excellent	Excellent
TARBELL	Easy to set off blocks of code, standard REM statements	Good - editing is confusing and prone to crashes	Poor - due to "line descriptors" (see special features)	Excellent - designates lines in error
OPUS	Flexible standard REM statements allow structured programming, but use of spaces is confusing	Good	Poor	Fair
APPLESOFT II	Standard REM statements	Good disk operating system	Good - except for color graphics	Very good
COMMODORE PET	Standard REM statements	Inconvenient disk operating system	Good - except for graphics and I/O	Very good
TRS-80	Standard REM statements	Excellent	Excellent	Excellent
NORTH STAR	Standard REM statements	Excellent	Excellent	Fair
HP-2000 TS	Standard REM format limited to entire line	Excellent	Excellent	Fair
BASIC PLUS	Standard REMs, append comments with "!", embedded comments allowed	Excellent	Excellent	Excellent

age, and variable pointers which simplify program modification. Some of the early hardware problems with key contact bounce have been solved by the use of silicone spray treatment and software modification. The expansion interface bug detected in the unit used for this evaluation was corrected free of charge in three days at the area service store.

North Star Basic — This system was implemented by Charles Grant and Mark Greenberg of North Star Computers, Inc. It is a well documented system, similar in style to the HP Basic, and has a very simple and convenient line editor. It was an early entry into the personal computer field, in conjunction with the North Star mini-floppy disk. Consequently, much software exists in North Star Basic. The system is available on disk in 8, 10, 12, or 14 digit integer precision, and the smallest version requires 11.5K of memory. The efficient disk operating system provides relatively fast and quiet file access.

HP-2000 TS Basic — This older generation minicomputer-based system was designed specifically to execute Basic efficiently in a time-sharing environment and serves 32 users. It has been superceded by the HP-3000 series of computers with which it is downwardly compatible. It is a very simple and convenient system to use, but the HP Basic does not have many of the convenient extended features available on most small computers.

PDP-11/45 Basic-Plus under RSTS/E — Basic-Plus is one of the finest Basic languages available. It is implemented on the PDP-11/45 under a time-sharing operating system. It is well suited for the beginner because it is convenient and easy to use as well as for the expert interested in serious programming because of the advanced features provided. An easily implemented "EXTEND" option provides this powerful extension, but seriously reduces the outward transportability of resulting programs. There is extensive external documentation and excellent utility program support.

The data presented here may be useful to programmers interested in comparing Basic systems. The features evaluated will be of interest for many user applications, but the scope of the study did not permit investigation of such important areas as file management and program optimization using integer arithmetic. Reference 5 presents a thorough discussion of software interpreters, and References 6-8 present other evaluations of small computer software systems.

IV. Acknowledgements

We wish to thank a number of persons who helped us on this project. In particular we want to thank the following for running the benchmark programs and assisting in the evaluation: Mark Kleine, UW- Parkside student, on the TRS-80; Dr. Don T. Piele,, UW-Parkside mathematics professor, on the North Star Horizon; Dr. Howard R. Gage, mathematics professor at Whitworth College, Spokane, WA, on Basic-Plus; and Jim Dunion of the American Museum of Science and Energy in Oak Ridge, TN, on the Commodore PET. We appreciate the suggestions and comments of our UW-Parkside colleagues Ron Gatterdam and Ming Kuo and our colleagues Dave Boyd and P.R. Bell at the Oak Ridge Institute for Energy Analysis where much of this work was done. We appreciate the excellent support of IEA secretary Ms Janet Kile.

Finally, we appreciate the cooperation of the distributors of Cbasic, Microsoft, Tarbell, and Opus for making these systems available for this evaluation. □

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Microcomputer in Graphic Communications Laboratory

Because of the advanced computer technology and the hardware mass production, the cost of a personal microcomputer is relatively inexpensive. More and more people use it at home, in school, farm, business, and industry for computing, data control/processing, information storing, retrieving, and etc. As technology educators, we should be aware of the impact of computers to industry, and to society. It is the time for us to seriously consider the numerous educational applications, especially in the laboratory, and to introduce the computer technology as well as the technical related utilizations to the students.

A packaged microcomputer system usually consists of a computer component, keyboard, visual terminal, with a storing and retrieving device. Additional interface devices such as printer, plotter, etc. can be added later. The capacity of a microcomputer depends on the size of it's memory. In most cases, starting with a small memory size, then, it can be expanded later with only very simple modification as funds are available.

The language or program used for a microcomputer usually is "BASIC" - Beginners All Purpose Symbolic Instruction Code. It is a higher level computer language which means that the programming is very close to English communication. Any person with a minimum of instruction and practice, should be able to write programs or modify programs for the individual laboratory application. The author has developed several programs for graphic communications laboratory data controls, such as: Calculating multiple exposure times for producing a halftone negative, Computing line negative exposure time with the consideration of all variables, Copy fitting, Step by step processing a roll of 35mm B/W film with actual timing, and exposure times for using various polycontract filters, etc. It has been demonstrated that students were motivated to use the microcomputer to figure out needed data for their laboratory practices, instead of the traditional scales and computing wheels. In addition, quality control concepts and computer applications in graphic communications industry are introduced to the students.

In order that you may like to try and start to use your school's microcomputer, there is a sample program in copy fitting for you. The program was written for the Schoolbook typeface in Radio Shack Level II Language. It can be modified very easily to suit any other kind of microcomputer you may utilize.

If you wish to apply it for a particular typeface, the change can be made in line 40. The line 40 consists of six assignment statements which gave the information to the microcomputer for the number of characters per pica of those six most common type sizes. (6, 8, 10, 12, 14, and 18 points). For example: A(6)=3.9 means that 3.9 characters can be fitted into a space with 1 pica line length when the 6-point type size of the Schoolbook is used. The information of characters per pica for a certain size and a certain style type can be obtained from a type specimen book.

Figure 1 shows the program itself, it can be entered into the computer at the programming mode. After the entire program is typed in, then a code "RUN" will give you the users mode. Figure 2 indicates the actual visual display during a run operation.

```
10 REM* LEVEL II, RADIO SHACK, SEP. 1981, BY WAN-LEE CHENG, TYPED BY K. SMART*
20 REM* COPY FITTING PROGRAM MODIFIED FROM HENRY'S*
30 DIM A(18)
40 A(6)=3.9: A(8)=2.9: A(10)=2.3: A(12)=1.9: A(14)=1.7: A(18)=1.3
50 CLS : PRINT "THIS PROGRAM WILL GIVE YOU THE COLUMN DEPTH FOR"
60 PRINT "SETTING SCHOOLBOOK TYPE WHEN A TYPEWRITTEN TEXT IS AVAILABLE" : PRINT : PRINT
70 INPUT "WHAT LINE LENGTH WOULD YOU LIKE TO SET (IN PICAS MAX.45.0)";X
80 IF X < 1 OR X > 45 GOTO 320
90 PRINT "WHAT IS THE TOTAL NUMBER OF CHARACTERS AND SPACES IN THE"
100 INPUT "FIRST FIVE LINES OF THE TYPEWRITTEN TEXT";T
110 INPUT "WHAT TYPE SIZE WOULD YOU SELECT (6, 8, 10, 12, 14, 18, POINTS)";Y
120 IF Y> 18 THEN 300
130 IF A(Y)=0 THEN 300
140 INPUT "WHAT LINE SPACE WOULD YOU USE (IN POINT)";L
150 E=Y+L : G=T/5
160 INPUT "HOW MANY LINES IN THE TYPEWRITTEN TEXT";H
170 M= ((( G*H) / A(Y) )/X) * E
180 D=M/12
190 N= INT(M) - (INT(D) * 12)
200 PRINT "THE COLUMN DEPTH IS "INT(D)  "PICAS & "N  "POINTS" : Q= INT(D)   (INT(D/6) *
210 IF Q=1 THEN T=1: R=6: GOTO 260
220 IF Q=2 THEN T=1: R=3: GOTO 260
230 IF Q=3 THEN T=1: R=2: GOTO 260
240 IF Q=4 THEN T=2: R=3: GOTO 260
250 IF Q=5 THEN T=5: R=6: GOTO 260
255 IF Q=0 THEN T=0 : R=0
260 PRINT "OR IT IS" INT (D/6) "-"T"/"R"INCHES"
270 INPUT " WOULD YOU LIKE TO COMPUTE ANOTHER ONE";J$
280 IF J$= "YES" THEN 290 ELSE 340
290 CLS: GOTO 70
300 PRINT "ERROR, THE TYPE SELECTION IS OUT OF RANGE"
310 GOTO 110
320 PRINT "ERROR, LINE LENGTH EXCEEDS RANGE"
330 GOTO 70
340 PRINT " THE COPY FITTING INFORMATION HAS BEEN GIVEN"
350 PRINT " GO AHEAD TO CHECK YOUR LAYOUT, AND SET TYPES"
360 END
```

Figure 1. Program Listing. Copy Fitting For Typesetting.

It was published by the <u>School Shop</u>, March 1982

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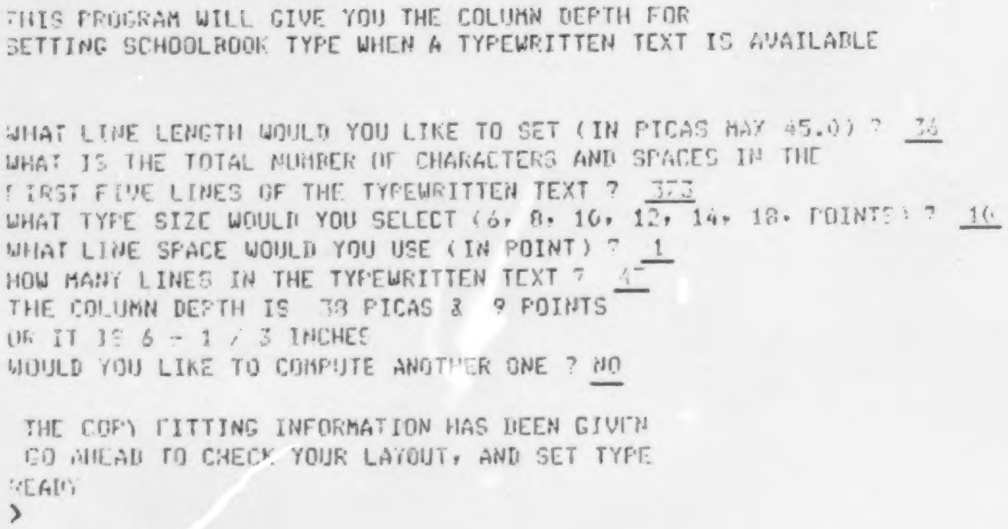

```
THIS PROGRAM WILL GIVE YOU THE COLUMN DEPTH FOR
SETTING SCHOOLBOOK TYPE WHEN A TYPEWRITTEN TEXT IS AVAILABLE


WHAT LINE LENGTH WOULD YOU LIKE TO SET (IN PICAS MAX 45.0) ? 36
WHAT IS THE TOTAL NUMBER OF CHARACTERS AND SPACES IN THE
FIRST FIVE LINES OF THE TYPEWRITTEN TEXT ? 373
WHAT TYPE SIZE WOULD YOU SELECT (6, 8, 10, 12, 14, 18, POINTS) ? 10
WHAT LINE SPACE WOULD YOU USE (IN POINT) ? 1
HOW MANY LINES IN THE TYPEWRITTEN TEXT ? 47
THE COLUMN DEPTH IS  38 PICAS &  9 POINTS
OR IT IS 6 - 1 / 3 INCHES
WOULD YOU LIKE TO COMPUTE ANOTHER ONE ? NO

 THE COPY FITTING INFORMATION HAS BEEN GIVEN
 GO AHEAD TO CHECK YOUR LAYOUT, AND SET TYPE
READY
>
```

Figure 2. Example of Visual Display During The User's Mode.

A Simplified Method of Calculating Halftone Exposure Data - Using Microcomputer

This is another application of using microcomputer to manage and control processing data in the area of graphic communications - determining halftone exposures. Currently, several calculating devices are generally used to figure out halftone reproduction exposure data, such as Kodak Q-12, Kodak Q-15, and Dupont computer, etc. However, there are many steps involved to set-up and use the computing devices. It may take a while for students to get familiarized and operate it properly. A microcomputer with the presented program will certainly simplify the calculating and decision making task.

With the traditional two-aim control method, a halftone photograph is reproduced thru two major exposures : the main exposure, and the flash exposure. An additional bump exposure can be applied if a highlighting or more contrast result is desired. However, a proper main exposure adjustment must be made to achieve the quality reproduction. This program will compute and provide the two major exposure data and leave the bump exposure along with the necessary adjustment to the individual who uses it.

In order to determine the halftone exposures, several basic calibration data are needed, such as: basic highlight density, basic main exposure, basic shadow density, basic flash exposure, and basic density range. Those information can be obtained by calibrating the process camera and the halftone screen. Once the data established, they can be continuously used as long as the processing materials and the darkroom procedures are not changed.

This halftone exposure program was written in Radio Shack Level II BASIC language based on the DuPont Publication - the Contact Screen Story. With minor modification, the program can be adapted to any other make of microcomputer. The program will provide the user with the main exposure, and the flash exposure settings when the basic calibration data and the measured copy highlight, shadow densities of the continuous tone photograph, and the desirable reproduction percentage are available. Figure 1 is an actual display of the user's mode.

Figure 2 show~~ed~~s the program. Two one-dimensional arrays were used. Line 80 to 140 provided the main exposure factors which are the antilogs of highlight density differences (the difference between copy and basic highlight densities)[1]. For example, A (3) = 1.07 means that if the highlight density difference is 0.03, then the main exposure factor is 1.07. The array B appeared on lines 150-170 are flash exposure factors which were derived from the DuPont Shadow Flash Computer [2]. Lines 390 and 440 are two integrated formulas, one of the two will be executed to calculate the copy main exposure with the consideration of reproduction percentage. Certain limits were set in the program, either the highlight density difference is beyond the range of -0.3 to +0.3 (line 350) or the excess density range exceeds the value of 1 (line 460), a message of "Sorry, this is out of the limit. Check with your instructor" will be displayed on the screen.

---

1. The Contact Screen Story, Camera Technical Data, E.I. DuPont DeNemours & Co., Delaware: Wilminton, pp. 92.

2. The Contact Screen Story, p. 21.

```
THIS PROGRAM WILL HELP YOU TO DETERMINE THE
PROPER EXPOSURE SETTINGS FOR PRODUCING HALFTONE
IMAGES FROM A CONTINOUS TONE COPY.
(THE INFORMATION IN THIS PROGRAM IS BASED ON THE
DUPONT'S PUBLICATION --- THE CONTACT SCREEN STORY).


PLEASE ENTER 'CONT' WHEN YOU ARE READY.


LET'S START WITH YOUR CALIBRATION OF 'BASIC' DATA.


PLEASE ENTER THE BASIC HIGHLIGHT DENSITY  ?  .39
PLEASE ENTER THE BASIC MAIN EXPOSURE TIME ?   56
PLEASE ENTER THE BASIC SHADOW DENSITY ?       1.42
PLEASE ENTER THE BASIC FLASH EXPOSURE TIME ?   16


THE SCREEN RANGE (BASIC DENSITY RANGE) IS      1.03


NOW YOU WILL ENTER YOUR 'COPY' DATA


PLEASE ENTER THE HIGHLIGHT DENSITY OF YOUR COPY ?  .09
PLEASE ENTER THE SHADOW DENSITY OF YOUR COPY ?     2.05
PLEASE ENTER THE % REPRODUCTION YOU WANT ?          50

THE HALFTONE EXPOSURE SETTINGS FOR YOUR COPY ARE:

THE MAIN EXPOSURE IS      15.75    SEC.

THE FLASH EXPOSURE IS    14.08    SEC.

WOULD YOU LIKE TO CALCULATE ANOTHER COPY?  YES OR NO? NO

THIS IS THE END OF THE PROGRAM.

GOOD LUCK ON YOUR DARKROOM WORK.
```

Figure 1 **Visual Display During a Run Operation**

```
5 REM * HALFTONE EXPOSURE CALCULATION  PROGRAMMED BY WAN LEE CHENG, [illegible]
2 *
10 REM * RADIO SHACK TRS-80 LEVEL II
20 PRINT "THIS PROGRAM WILL HELP YOU TO DETERMINE THE
30 PRINT "PROPER EXPOSURE SETTINGS FOR PRODUCING HALFTONE
40 PRINT "IMAGES FROM A CONTINUOUS TONE COPY.
50 PRINT "(THE INFORMATION IN THIS PROGRAM IS BASED ON THE
60 PRINT "DUPONT'S PUBLICATION --- THE CONTACT SCREEN STORY)."
70 DIM A(31), B(11)
80 A(0)=1: A(1)=1.02: A(2)=1.04: A(3)=1.07: A(4)=1.09
90 A(5)=1.12: A(6)=1.14: A(7)=1.17: A(8)=1.20: A(9)=1.23
100 A(10)=1.25: A(11)=1.28: A(12)=1.31: A(13)=1.34: A(14)=1.38
110 A(15)=1.41: A(16)=1.44: A(17)=1.47: A(18)=1.51
120 A(19)=1.54: A(20)=1.58: A(21)=1.62: A(22)=1.66
130 A(23)=1.69: A(24)=1.73: A(25)=1.77: A(26)=1.82
140 A(27)=1.86: A(28)=1.90: A(29)=1.94: A(30)=2.00
150 B(0)=0: B(1)=0.15: B(2)=0.35: B(3)=0.50
160 B(4)=0.63: B(5)=0.72: B(6)=0.78: B(7)=0.84
170 B(8)=0.86: B(9)=0.88: B(10)=0.90
180 PRINT:PRINT:PRINT "PLEASE ENTER 'CONT' WHEN YOU ARE READY."
190 STOP
200 CLS
210 PRINT:PRINT:PRINT
220 PRINT "LET'S START WITH YOUR CALIBRATION OF 'BASIC' DATA." :PRINT:PRINT
230 INPUT "PLEASE ENTER THE BASIC HIGHLIGHT DENSITY    ";C
240 INPUT "PLEASE ENTER THE BASIC MAIN EXPOSURE TIME    ";D
250 INPUT "PLEASE ENTER THE BASIC SHADOW DENSITY    ";E
260 INPUT "pLEASE ENTER THE BASIC FLASH EXPOSURE TIME    ";F
270 G = E - C
280 PRINT:PRINT:PRINT "THE SCREEN RANGE (BASIC DENSITY RANGE) IS    ";G
290 PRINT:PRINT:PRINT "NOW YOU WILL ENTER YOUR 'COPY' DATA    " :PRINT:PRINT
300 INPUT "PLEASE ENTER THE HIGHLIGHT DENSITY OF YOUR COPY    ";H
310 INPUT "PLEASE ENTER THE SHADOW DENSITY OF YOUR COPY    ";I
320 INPUT "PLEASE ENTER THE % REPRODUCTION YOU WANT    ";P
330 J = H - C
340 IF J < 0 AND ((ABS(J)<.3) OR (ABS(J)=.3)) THEN 410
350 IF ABS(J) > .3 THEN 550
360 J = J + 0.005
370 J = J * 100
380 O = INT(J)
390 K = (D * A(O)) * (((1 + (P/100))↑ 2)/4)
400 GOTO 450
410 J = J - 0.005
420 L = (-J) * 100
430 O = INT(L)
440 K = (D / A(O)) * (((1 + (P/100))↑ 2)/4)
450 M = (I - H) - G
460 IF M > 1 THEN 550
470 IF M < 0 THEN 580
480 M = M + 0.05
490 X = M * 10
500 Y = INT(X)
510 N = F * B(Y)
520 PRINT:PRINT "THE HALFTONE EXPOSURE SETTINGS FOR YOUR COPY ARE:"
530 PRINT:PRINT "THE MAIN EXPOSURE IS:    ";K; "    SEC."
540 PRINT:PRINT "THE FLASH EXPOSURE IS:    ";N; "    SEC.":  GOTO 610
550 PRINT:PRINT "SORRY. THIS IS OUT OF THE LIMIT.  CHECK WITH YOUR";
560 PRINT " INSTRUCTOR."
570 GOTO 610
580 PRINT:PRINT "IN THIS CASE, YOU DON'T NEED THE FLASH EXPOSURE."
590 N = 0
600 GOTO 520
610 PRINT:PRINT:PRINT
620 INPUT "WOULD YOU LIKE TO CALCULATE ANOTHER COPY?  YES OR NO";S$
630 CLS
640 IF S$ = "YES" THEN 220
650 CLS:  PRINT "THIS IS THE END OF THE PROGRAM."
660 PRINT:PRINT:PRINT "GOOD LUCK ON YOUR DARKROOM WORK."
670 END
```

Figure 2 Halftone Exposure Calaulation Program

It will be published by the School Shop in August, 1982.

Test Data for the Halftone Exposure Program

Basic Data	
B. Highlight	0.39
Main Exp.	56 sec.
B. Shadow	1.42
Flash Exp.	16 sec.
B. Density Range	1.03

Copy Data		TRS-80 Computer		Kodak Q-12	
C. Highlight	0.21	Main Exp.	20.8609=	Main Exp.	21.2=
C. Shadow	1.51		21 sec.		21 sec.
% Repro.	50%	Flash Exp.	8 sec.	Flash Exp.	7.5 sec.
C. Highlight	0.17	Main Exp.	25.8283=	Main Exp.	27 sec.
C. Shadow	2.01		26 sec.	Flash Exp.	13.5 sec.
% Repro.	75%	Flash Exp.	13.76=		
			14 sec.		
C. Highlight	0.12	Main Exp.	30.1075=	Main Exp.	31.5 sec.
C. Shadow	1.01		30 sec.	Flash Exp.	0 sec.
% Repro.	100%	Flash Exp.	0 sec.		
C. Highlight	0.30	Main Exp.	57.622=	Main Exp.	60 sec.
C. Shadow	1.01		57.5 sec.	Flash Exp.	0 sec.
% Repro.	125%	Flash Exo.	0 sec.		
C. Highlight	0.11	Main Exp.	46.0527=	Main Exp.	47.5 sec.
C. Shadow	1.81		46 sec.	Flash Exp.	12.5 sec.
% Repro.	150%	Flash Exp.	13.5 sec.		
C. Highlight	0.15	Main Exp.	Out of Limit	Main Exp.	62.5 sec.
C. Shadow	2.51	Flash Exp.	Out of Limit	Flash Exp.*	23 sec.
% Repro.	175%				
C. Highlight	0.13	Main Exp.	69.2308=	Main Exp.	72 sec.
C. Shadow	1.93		69 sec.	Flash Exp.	13 sec.
% Repro.	200%	Flash Exp.	13.76=		
			14 sec.		
C. Highlight	0.11	Main Exp.	29.4737=	Main Exp.	30.5 sec.
C. Shadow	2.01		29.5 sec.	Flash Exp.	13.75=
% Repro.	100%	Flash Exp.	14.08=		14 sec.
			14 sec.		

Test Data Con't

Copy Data		TRS-80 Computer		Kodak Q-12	
C. Highlight	0.37	Main Exp.	47.3257= 47.5 sec.	Main Exp.	48 sec
C. Shadow	1.31			Flash Exp.	0 sec.
% Repro.	87.5%	Flash Exp.	0 sec.		
C. Highlight	0.18	Main Exp.	39.0239= 39 sec.	Main Exp.	40 sec
C. Shadow	1.42			Flash Exp.	6 sec.
% Repro.	112.5%	Flash Exp.	$5.\overline{6}$= 5.5 sec.		

* Out of Limit -- Kodak Q-12 flash exposure chart.

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APPLICATIONS OF CONFORMAL MAPPING TO POTENTIAL THEORY THROUGH COMPUTER GRAPHICS

DONALD T. PIELE, MORRIS W. FIREBAUGH AND ROBERT MANULIK

Abstract. Many problems in the physical sciences can be described by potentials and thus can often be solved through the application of conformal mapping. The primary limitation of this approach, especially in the classroom, is the tedious calculation and plotting that a visual image entails. We have eliminated this difficulty by the use of interactive computer graphics. By observing directly the direction and speed of mappings as they occur, students develop a deeper understanding of the nature of complex mappings which, without the computer, only experts achieve. We believe that this is just one example of many problems in physics and mathematics in which the computer can serve as an "analytical microscope" of exceptional power, clarity, and resolution.

1. Introduction. Potential theory is used in the mathematical investigation of a great variety of natural phenomena. It is particularly valuable in describing fluid dynamics, heat flow, and electromagnetic and gravitational fields. If the physical geometry of the problem can be reduced to two dimensions, the full power of complex analysis may be brought to bear, and many otherwise difficult or intractable problems readily yield a solution.

Nearly all upper level college textbooks in complex analysis for students in mathematics and the physical sciences contain a chapter on the applications of conformal mapping to the problems in potential theory. Here students are exposed, possibly for the first time, to one of the more elegant examples in mathematics where the laws of nature and new mathematical concepts are combined to make a "whole" greater than the sum of its parts. Historically, this occurred very naturally. Lagrange (1736–1813) first isolated the potential function in his studies of fluid flow. Riemann (1826–1866) developed many of his ideas about complex functions through his studies of the flow of electrical currents along a plane [1].

To appreciate this synthesis, the student needs more than an analytical understanding alone. Unless visualized, conformal maps are difficult to fully understand. But even the simplest mappings are hard to draw and we are discouraged from developing our understanding which so often is pictorially dependent. For example, we all have a mental picture of the graph of $\sin(x)$ for x real, because we have constructed it many times. But how many can visualize the graph of $\sin(z)$ for a complex z on a pair of grid lines $x = c$ and $y = c$? We all have seen, at some time, the argument proving that conformal maps conserve the magnitude and sense of angles, but how many times have we observed it other than in textbooks? Even more regrettably, few of the visually striking flow patterns or equipotential graphs that appear in texts are ever explained in terms of how they were constructed. Occasionally, an equation is given, but its implicit form makes it difficult to handle and students are never seriously asked to construct the level curves with it.

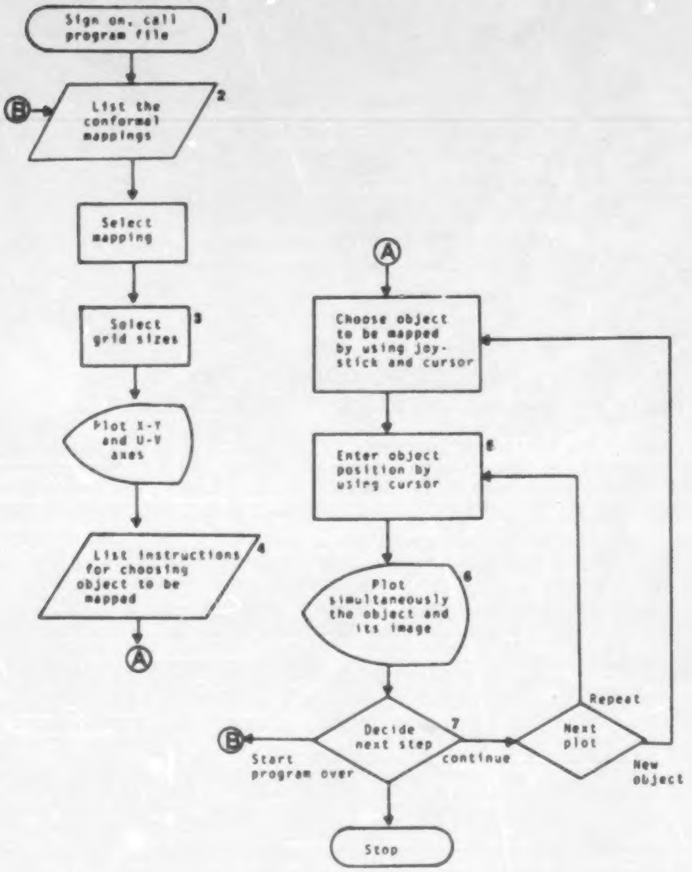

Sign on, call program file
1
B
List the conformal mappings
2
Select mapping
Select grid sizes
3
Plot X-Y and U-V axes
List instructions for choosing object to be mapped
4
A
A
Choose object to be mapped by using joy-stick and cursor
Enter object position by using cursor
5
Plot simultaneously the object and its image
6
Decide next step
7
B
Start program over
continue
Next plot
Repeat
New object
Stop

Fig. 1. Operational flowchart for conformal mapping program.

In this paper we shall show how interactive computer graphics can be used to view conformal transformations. We shall apply this technology to construct flow lines and equipotential lines for potentials associated with problems in fluid dynamics and electrostatics. We conclude by reconstructing a proof of Steiner's theorem using conformal mapping.

Without the graphical capabilities of computers, our approach, while still possible, is laborious, impractical and limited by the static nature of the resulting map. The dynamic capabilities of computer graphics can be used to simultaneously convey information about line identity, stretching, and the sense of mappings which, in textbooks, is difficult to present.

2. Computer graphics system and program.

Graphics Hardware. We begin with a brief description of the graphics system on which our program was developed, since it differs in several respects from other instructional computer graphics projects [2, 3].

The graphics terminal is a Princeton Electronics Products 801 video terminal [4] with a 10″ × 10″ screen with 1000 line resolution. The terminal is teletype compatible and stores information locally on a LITHOCON silicon storage tube. Such memory permits selective erase of single characters, character lines, points, and vectors. The terminal has a joystick driven cursor for entering position data directly from the screen, and hardware zoom for 4*X*, 9*X*, and 16*X* magnification. The most significant hardware feature, from the instructional point of view, is the video compatibility of the system. The graphics information displayed on the screen may be simultaneously presented on closed circuit television, projected by video projector, or recorded on video tape. With minimal programming effort, the video graphics output may be transmitted to a plotter for high resolution hardcopy graphics output, **[5]**.

Our terminal is linked by telephone to the UNIVAC 1110 at the Madison Academic Computing Center. Programs are available as public files to all users throughout the University of Wisconsin system.

CONFORMAL MAPPING PROGRAM. *Operational Characteristics.*

In Fig. 1 we present the operational flowchart for the conformal mapping program. To illustrate the interactive nature of this program we will describe a typical terminal session in which an instructor is demonstrating the properties of conformal maps for a class or a student is investigating these properties for himself. The numbering below corresponds to the numbering on the flowchart.

1. The user dials the UNIVAC 1110 on the dataphone, signs on, requests the program file and executes it in four lines of instruction from the terminal keyboard.

2. The program responds with the following output text to the graphics screen.

```
THIS PROGRAM PERFORMS CONFORMAL MAPPING FROM THE X-Y PLANE TO THE U-V
PLANE. IT CAN ALSO PERFORM THE INVERSE MAPPING. THE FOLLOWING IS OUR MENU
OF FUNCTIONS
 1) FRACTIONAL LINEAR TRANSFORMATION
 2) EXP(Z)
 3) LN(Z)
 4) COSINE(Z)
 5) SINE(Z)
 6) W = EXP(Z) + Z
 7) HYPERBOLIC SINE(Z)
 8) HYPERBOLIC COSINE(Z)
 9) W = Z**2
10) W = Z + 1/Z (JOUKOWSKI TRANSFORMATION)
111) W = i*(EXP(Z)+1)/(EXP(Z)-1)
12) CURRENTS IN A HOUSE WALL
13) PARALLEL PLATES, SOURCE AT 1, SINK AT INFINITY
14) FLOW IN A REACTOR (SOURCE AND SINK)
15) LINE CHARGE BETWEEN PARALLEL PLATES
16) FLOW AGAINST A WALL
17) FLOW IN A REACTOR
18) FLOW AGAINST A BARRIER
19) FLOW AGAINST A POLE

TYPE THE NUMBER OF THE FUNCTION YOU WISH TO USE
```

The user responds with the desired transformation number.

3. The program next requests the grid size to be used in plotting the $X-Y$ and $U-V$ axes. These are supplied by the user, depending on the function requested. If the optimum range is not obvious from inspection of the function, it is quickly learned by trial and error. Upon input of the grid size, the $X-Y$ and $U-V$ axes are immediately plotted on the top two-thirds of the screen.

4. On the bottom one-third of the screen the following instructions appear:

```
CHOOSE OBJECT TO BE MAPPED BY PUTTING CURSOR IN BOX AND PUSHING "END"
BUTTON
☐ POINTS: GIVE ONE POINT BY POSITIONING CURSOR, PUSH END.
☐ VERTICAL LINES: GIVE ONE POINT ON LINE.
```

☐ HORIZONTAL LINES: GIVE ONE POINT ON LINE.
☐ ARBITRARY LINES: GIVE TWO POINTS ON LINE.
☐ CIRCLES: GIVE CENTER POINT, THEN ANY POINT ON CIRCLE.
☐ LINE SEGMENTS: GIVE TWO END POINTS.
TO START PROGRAM OVER OR QUIT, PUSH "HOME", THEN "END".

The user positions the cursor to select an object by manipulating the joystick and pressing a button.

5. The points which locate the object are next entered by using the joystick to position the cursor at the appropriate points on the $X-Y$ plane (or $U-V$ plane if the inverse is desired).

6. The computer plots simultaneously the object, which the user defined, on the $X-Y$ plane and its image under the conformal mapping on the $U-V$ plane. Steps 5 and 6 are repeated as often as required to display the desired pattern. As an example, we show in Fig. 2 a time lapse series of pictures of the display as horizontal lines on the $X-Y$ plane are mapped under the transformation $W = Z + e^Z$.

7. After mapping each object, the user has the option of mapping a different object, starting the program over using a different transformation, or terminating the run.

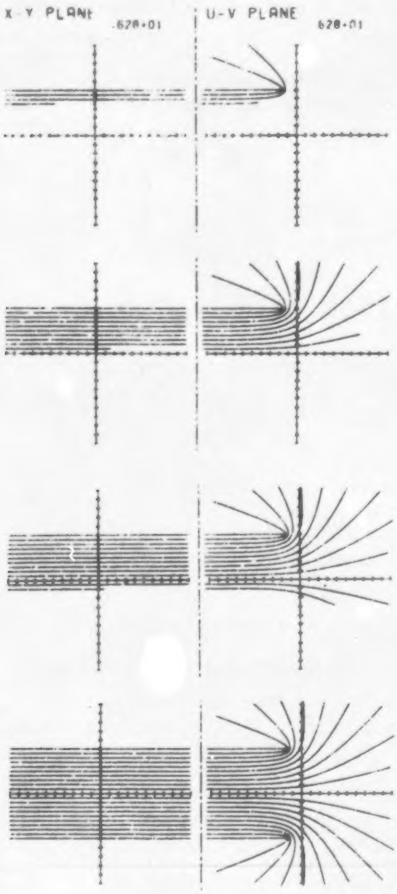


FIG. 2. $W = Z + e^Z$.

Program Details. Our program was written in FORTRAN and made extensive use of graphics subroutines available on the UNIVAC 1110. A similar program could be written in BASIC using a minimal amount of graphics subroutines since the graphics capabilities required to write our program are elementary: these include the ability to read and write text and the ability to read the cursor position. The general structure of the program is apparent from the operational flowchart shown in Fig. 1. However, this flowchart illustrates only the general outline of the program. We now examine in more detail programming problems that must be solved in order to construct satisfactory mappings.

In any graphics program written for displaying functions or mappings one encounters the problem of determining the proper scaling for both the domain and range axis. In our program, where we allow the user to choose different dimensions for the x–y plane and u–v plane, algorithms for scaling are especially important. This problem can be handled with graphics system subroutines, if they are available, or by writing algorithms directly into the program. This is not difficult to do since all problems of positioning and scaling a coordinate system can be reduced to finding the appropriate two-dimensional linear transformation.

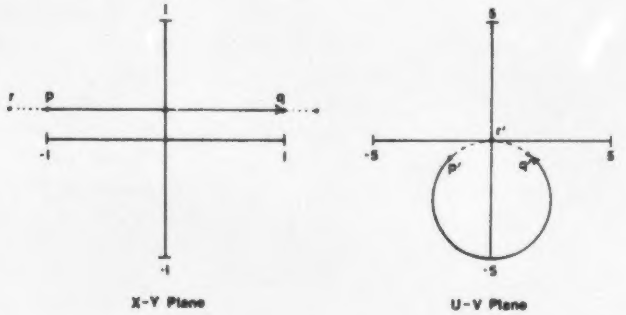


FIG. 3. The mapping $W = 1/Z$ which maps the point at infinity to zero.

Another problem involved in constructing conformal mappings is best illustrated by an example. In the fractional linear transformation $w = 1/z$ an entire line in the x–y plane is transformed into a circle in the u–v plane with the point at infinity being mapped to zero. This presents the problem of determining where to start and stop the sweep of the line in the x–y plane and what step size to use so that the image in the u–v plane is both complete and smooth. In Figure 3, if we start the sweep of a horizontal line in the x–y plane at $p = (-1, .2)$ and end it at $q = (1, .2)$ then the image under the mapping $w = 1/z$ is that portion of the circle from p' to q' shown in the u–v plane. To make an entire circle in the range it is necessary to either change the dimensions of the x–y axis or begin the map out of view to the left of $(-1, .2)$. In most cases the later is preferred because we keep the flexibility of choosing the dimensions we want for the domain of each function. To find the starting point in this case, a series of guesses are made and the image of each guess computed. The image of the point at infinity is also calculated and compared with the image of each guess. When the two are sufficiently close together the last guess is used as the starting point. For example, a starting point of $r = (-20, .2)$ puts the image r' within approximately 1/40 of zero. The line segment from r to p does not appear on the screen, but the image from r' to p' does; similarly for q' to r'.

The last problem is determining what step size to use in the sweep of the horizontal line. In the mapping $w = 1/z$ it would be impractical to use a uniform step size because the image near zero would move very slowly and the image near $(0, -5)$ would move rapidly through large jumps. To achieve a smooth circle drawn at a uniform rate, a step size is used that decreases exponentially as we approach the y-axis and increases exponentially as we move away. Once the start and end points are found, the program steps through the object in the x–y plane. Image points in the range and line segments between them are drawn following the construction of each line segment in the domain. Thus, each object and its image appear simultaneously on the screen

3. Applications of conformal mapping to potential theory. We now examine how our program was applied in two major areas of physics, fluid dynamics and electrostatics, and conclude with a theorem in mathematics.

FLUID DYNAMICS. The value of complex functions in the study of potentials is derived from the fact that if

$$w(z) = w(x, y) = u(x, y) + iv(x, y)$$

is an analytic function of the complex variable $z = x + iy$, then both u and v are potential functions and satisfy Laplace's equation. In addition, if $\phi(x, y)$ is a potential function then a conjugate potential $\psi(x, y)$ exists such that

$$F(z) = \phi(x, y) + i\psi(x, y) \tag{1}$$

is an analytic function. The function $F(z)$ is called the *complex potential* associated with the real potential ϕ, and we shall make repeated use of it in this paper.

Let us review the role that real and complex potentials play in Newtonian or ideal fluid flow. If fluid motion is irrotational and incompressible then its velocity field is determined by a velocity potential ϕ [6]. The associated complex potential (1) holds the key to a complete description of the flow field. Specifically, the conjugate of its first derivative, $\overline{F'(z)}$, is the velocity field; the streamlines, which trace the movement of the fluid in the field, are the level curves $\psi(x, y) = c$; and the level curves $\phi(x, y) = c$ are perpendicular to the streamlines and link points together with the same velocity (isovels).

The simplest type of fluid flow is uniform and horizontal and is characterized by the complex potential $F(z) = z$. Here the conjugate potential $\psi(x, y) = y$, and the streamlines are the horizontal lines $y = c$. The speed of the flow is uniform, $|F'(z)| = 1$.

To study more elaborate fluid flows, we again call upon complex functions. It is a routine exercise in complex analysis [7] to show that a conformal mapping (i.e., a complex analytic function $w(z)$ with a nonvanishing derivative) transforms velocity potentials and streamlines in the z plane into velocity potentials and streamlines in the w plane. Thus, flows that are intuitively understood in simple regions can be used to study flows in more complicated regions which are conformally equivalent.

Flow around a cylinder: We apply this idea to a well-known example in fluid dynamics—flow around a cylinder placed perpendicular to a uniform flow field. The region R_w outside the unit circle is mapped conformally onto the region R_z, outside the slit $[-2, 2]$ by the Joukowski Transformation.

$$z = 1/w + w. \tag{2}$$

The potential for uniform horizontal flow in the z plane, $F(z) = z$, corresponds to the potential $G(w) = w + 1/w$ for flow around the circle in the w plane. To construct the streamlines for G, we invert the Joukowski transformation (2) and solve for w

$$w = \tfrac{1}{2}(z + (z^2 - 4)^{\frac{1}{2}}). \tag{3}$$

A single valued branch for (3) can be defined [8] for the region R_z. We are now ready to let the computer take over and construct the streamlines for the potential $G(w)$. As z traverses a flow pattern in R_z, the image point w, determined by function (3), traverses the corresponding flow pattern in R_w. This is illustrated in Fig. 4 by a series of pictures taken from the computer graphics screen.

An explicit representation of the level curves can be found in polar form by substituting $w = re^{i\theta}$ in (2) and setting the imaginary part equal to a constant. For the Joukowski potential we find [9]

$$\psi(r, \theta) = (r - 1/r)\sin\theta = c. \tag{4}$$

However, even in this relatively simple example, the implicit representation (4) is not very convenient for actually constructing the flow lines. For more complicated potentials it becomes even less useful.

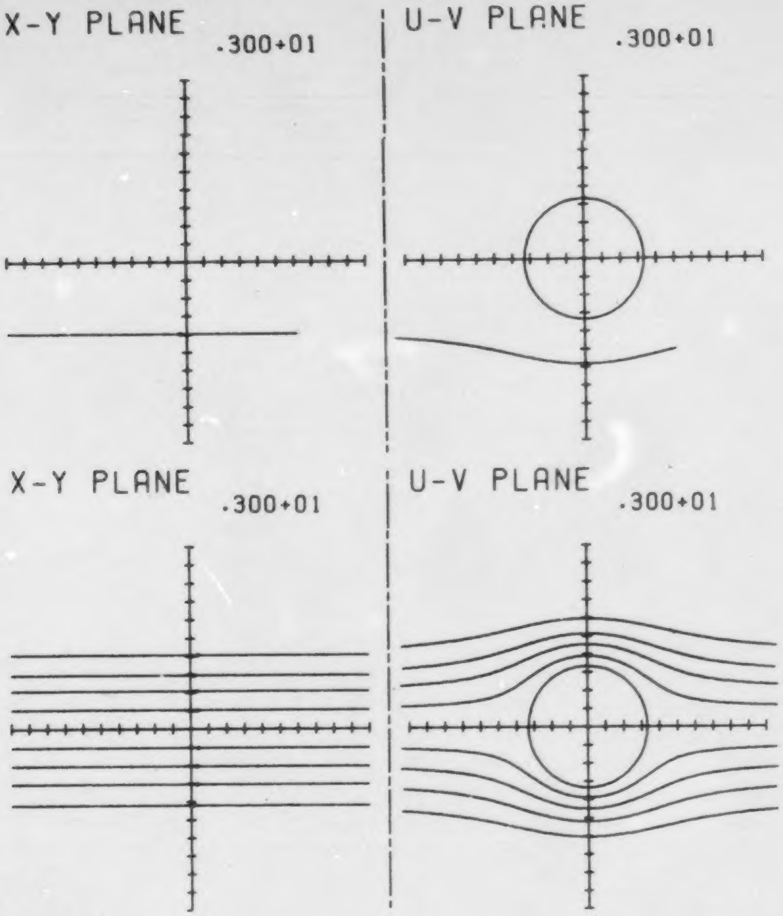


FIG. 4. Flow around a cylinder constructed with transformation (3).

The Airfoil: We carry the Joukowski transformation one step further and study the pure irrotational flow around an airfoil. The unit circle is mapped onto the line segment $[-2,2]$ in the z plane by (2). If a circle is centered near the origin and passes through the point $(1,0)$ then its image under (2) resembles the boundary of an airfoil as shown in Fig. 5. The shape of the airfoil can be changed by moving the center of the circle. To construct the streamlines for flow over the airfoil, we simply transform the streamlines around the cylinder in Fig. 4 into the corresponding streamlines for the airfoil under the Joukowski transformation

$$z' = w' + 1/w'. \tag{5}$$

The entire job can be done with one conformal mapping

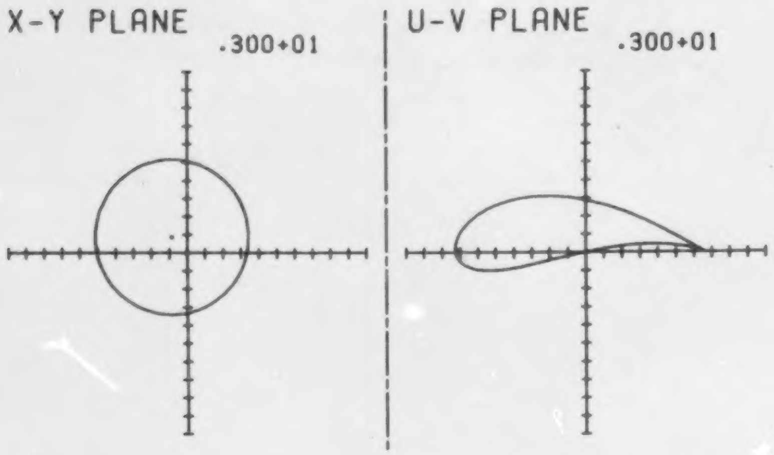


FIG. 5. The airfoil constructed with the Joukowski Transformation (2).

(6)
$$w' = \frac{r(z + (z^2 - 4)^{\frac{1}{2}}) + 2z_0'}{2} + \frac{2}{r(z + (z^2 - 4)^{\frac{1}{2}}) + 2z_0'}$$

that transforms the region R_z outside of the slit $[-2, 2]$ onto the region $R_{w'}$ outside of the airfoil. This mapping is easily constructed by composing the conformal mappings (2), (5) with the translation and contraction of the circle centered at z_0' onto the unit circle centered at the origin given by

(7)
$$w = (z' - z_0')/r.$$

Now the computer graphics program takes over. By traversing the horizontal lines in the complex z-plane, the image points in the w'-plane given by (6) map out the streamlines of the flow over the airfoil in a uniform horizontal flow as shown in Fig. 6. With the computer graphics capabilities, the airfoil can be easily studied in a variety of flow fields. Fig. 7(a) shows the streamlines for uniform flow against the airfoil at the incidence angle α. The Joukowski transformation can also be used to solve a related problem. By choosing $z_0' = 0$, the airfoil degenerates into the line segment $[-2, 2]$ so we can generate the flow lines around a flat plate shown in Fig. 7(b) using the same mapping (6).

Note that to more closely simulate the actual flow over an airfoil, it is necessary to introduce circulation [**10**].

Flow out of an open channel: Our final example in fluid dynamics illustrates the possibility of constructing streamlines for a flow problem using conformal mapping and computer graphics even when an explicit representation for the complex potential is impossible. Consider the region R_z between the lines $y = \pi$ and $y = -\pi$ in the complex z plane. This unbounded region is mapped conformally [11] by

(8)
$$w = z + e^z$$

onto the w plane minus the two half lines $-\infty < u \leqq -1, v = \pi$ and $-\infty < u \leqq -1, v = -\pi$. This region is denoted by R_w. Ideal fluid flow in the infinite channel R_z is of course horizontal. The flow lines through the open channel R_w corresponds to these horizontal lines under the conformal mapping (8) as shown in Fig. 8(a). To find the complex potential for this flow, equation (8) would have to be inverted and z written as a function of w. Such an explicit inversion is impossible using elementary functions.

Finally, we observe that the flow pattern for an open channel can also be interpreted as the

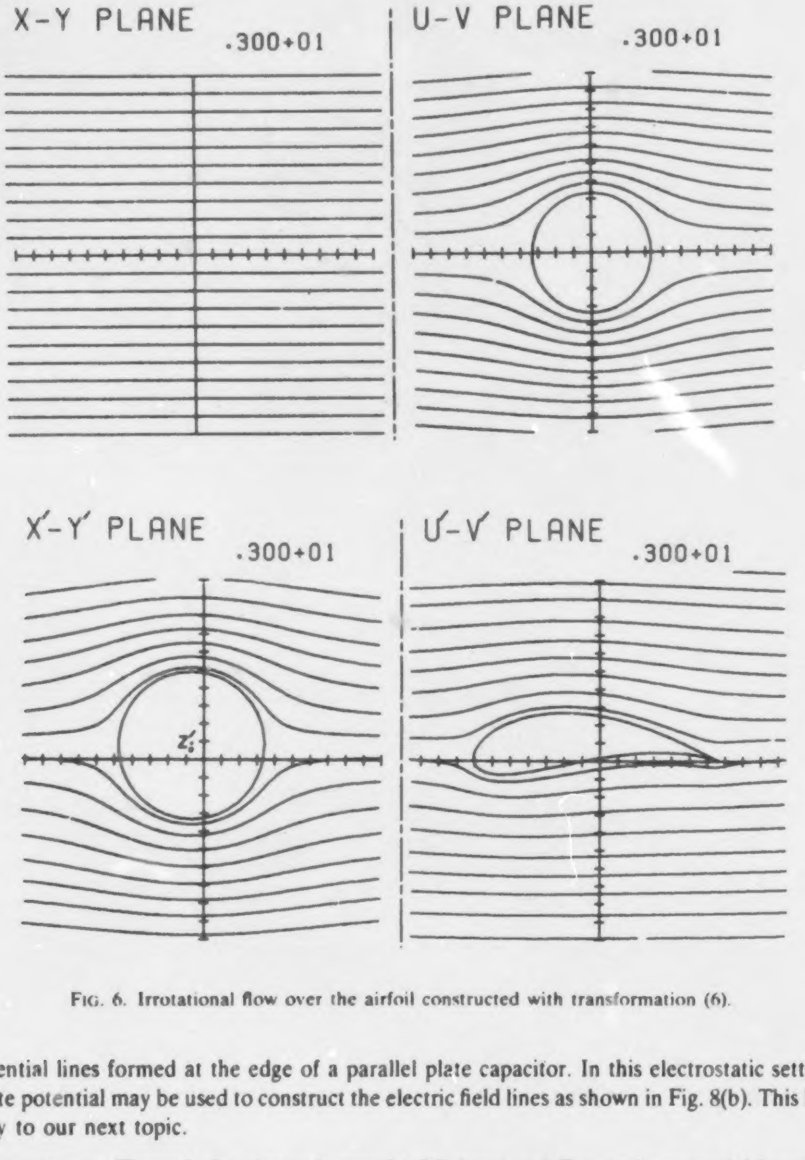
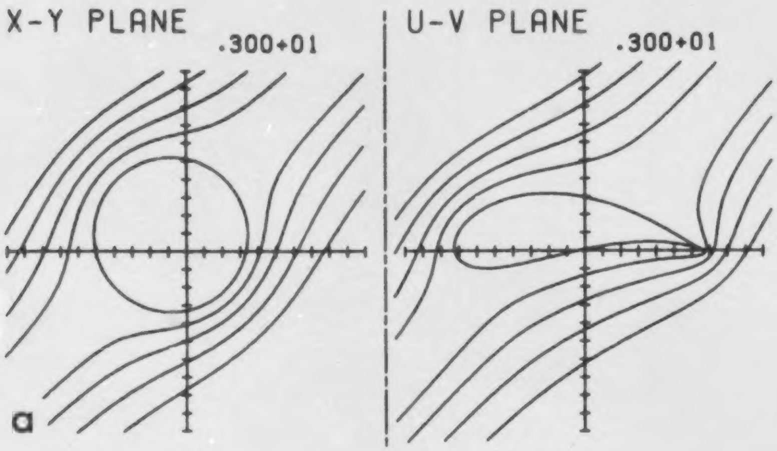


FIG. 6. Irrotational flow over the airfoil constructed with transformation (6).

equipotential lines formed at the edge of a parallel plate capacitor. In this electrostatic setting, the conjugate potential may be used to construct the electric field lines as shown in Fig. 8(b). This leads us naturally to our next topic.

ELECTROSTATICS. Through the pioneering work of Poisson and Gauss, the potential function was used by the beginning of the nineteenth century to describe fields in electrostatics and magnetostatics. However, very little was known about potential functions in general until George Green (1793–1841) undertook a thorough study of their mathematical properties [**12**]. In his privately published book *An Essay on the Application of Mathematical Analysis to the Theories of Electricity and Magnetism*, (1828), Green introduced a special function—later named the Green's function by Riemann—from which he inferred the possibility of solving a wide class of boundary value problems, known as the Dirichlet problem. We mention the Green's function here because it occurs naturally in many problems in electrostatics. In fact, Green inferred the existence of his special function from the Faraday cage experiment where static charge is always induced on a closed, grounded, conducting



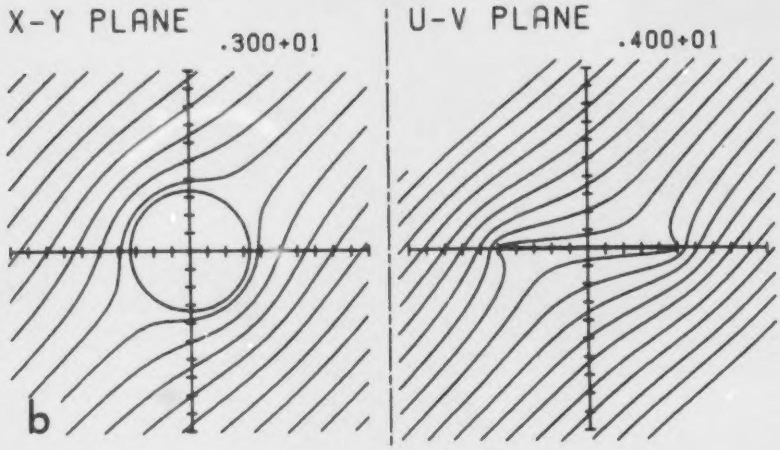


FIG. 7a. Flow against an airfoil at the incidence angle $\alpha = 45°$.

FIG. 7b. Flow against a flat plate at the incidence angle $\alpha = 45°$.

surface by a point charge within the conductor, such that the resulting combined potential vanishes on the surface [**13**].

We consider electrostatic fields for which complex analysis can be successfully applied. If the field $\vec{E}$ has a zero component in the z-direction (i.e., cylindrical geometry), then it is sufficient to study the field in a plane cross section where we can use the complex notation. In the charge-free region away from an electrode or conducting surface, the field $\vec{E}$ is determined by a real potential function $\phi(x, y)$ through the gradient

$$\vec{E} = -\left(\frac{\partial \phi}{\partial x} + i\frac{\partial \phi}{\partial y}\right). \tag{9}$$

Since ϕ is harmonic in the charge-free region, we can construct the complex potential [**14**]

$$F(z) = \phi(z) + i\psi(z) \tag{10}$$

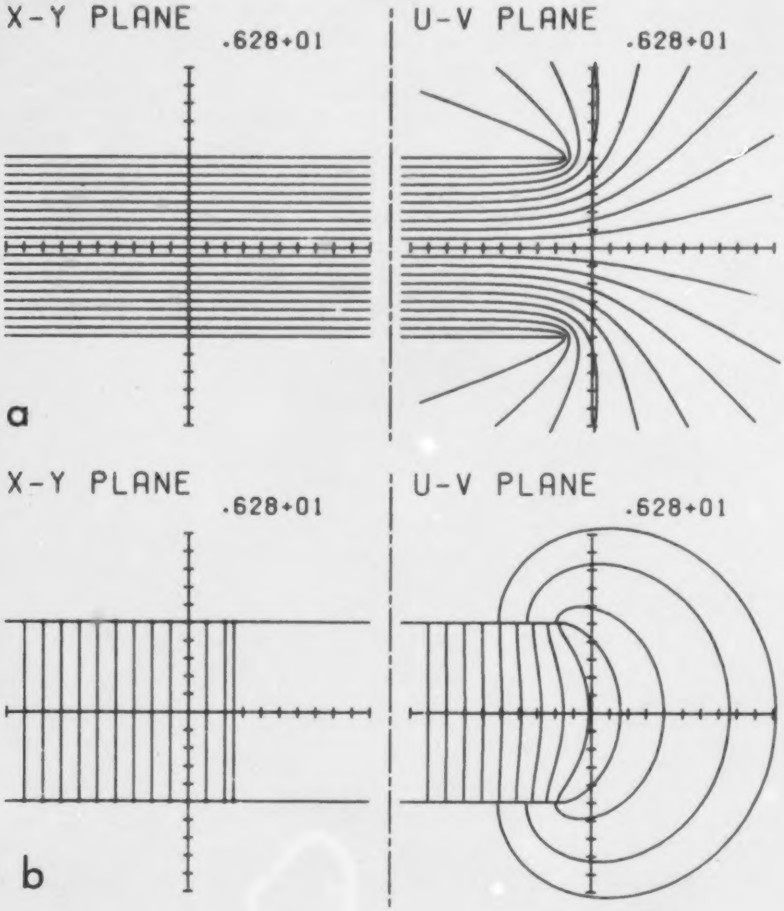


FIG. 8a. Flow out of an open channel or the equipotential lines formed at the edge of a parallel plate capacitor.

FIG. 8b. Lines of force at the edge of a parallel plate capacitor. Both *a* and *b* were constructed with transformation (8).

just as we did in fluid dynamics. Again we find that the potential $F(z)$ supports many properties of the field $\vec{E}$. For example, $\vec{E} = F'(z)$; the level curves $\phi(z) = c$ are the equipotential lines for $\vec{E}$; and the level curves $\psi(z) = c$ are the lines of force for a unit charge in the field $\vec{E}$.

To construct these level curves using conformal mapping, we consider the complex potential $F(z)$ as a transformation from the z-plane to the w-plane and write

$$w = F(z) = \phi(z) + i\psi(z). \tag{11}$$

If we express w in terms of its components, $w = u + iv$, the level curves $\phi(z) = c$ in the z-plane correspond to the vertical lines $u = c$ in the w-plane, and the streamlines $\psi(z) = c$ in the z-plane corresponds to the horizontal lines $v = c$ in the w-plane. Thus if we invert the transformation (9) and write z as a function of w

$$z = F^{-1}(w), \tag{12}$$

the images of the horizontal and vertical lines in the w-plane are precisely the streamlines and equipotential lines for the field $\vec{E}$ in the z-plane.

Line Charges: Consider the electrostatic field generated by two line charges of opposite sign running perpendicular to the x-y plane and passing through the points z_0 and $\bar{z}_0$. Clearly, the field $\vec{E}$ has a zero component in the z-direction. The two-dimensional real potential is given by [15]

$$\phi(z) = \frac{1}{2\pi} \log \frac{|z - z_0|}{|z - \bar{z}_0|}. \tag{13}$$

where $|z - z_0|$ denotes the distance between the point z and the line charge at z_0, and $\bar{z}_0$ is the complex conjugate of z_0.

The associated complex potential

$$F(z) = \frac{1}{2\pi} \log \frac{z - z_0}{z - \bar{z}_0} \tag{14}$$

follows immediately from the definition of the complex logarithm,

$$\log w = \log |w| + i \arg w. \tag{15}$$

Also, the conjugate function $\psi(z)$, can be derived from (15)

$$\psi(z) = \arg \frac{z - z_0}{z - \bar{z}_0}. \tag{16}$$

We are now ready to invert the complex potential (14) and solve for z in terms of w

$$z = \frac{\bar{z}_0 e^{2\pi w} - z_0}{e^{2\pi w} - 1}. \tag{17}$$

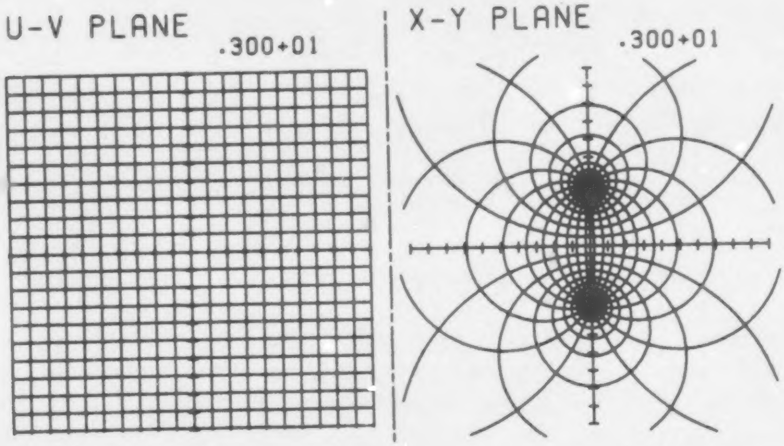


FIG. 9. The equipotential lines and the lines of force for two line charges of opposite sign, constructed with transformation (17).

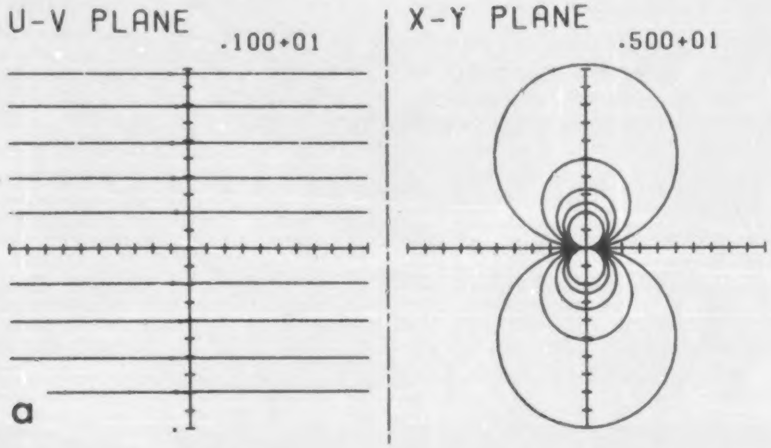
When we traverse the vertical and horizontal lines in the w-plane, the corresponding equipotential lines and force lines for the potential ϕ are constructed in the z-plane. This is a simple task for our graphics program and is illustrated for $z_0 = i$ in Fig. 9. Several remarks are in order.

1. The horizontal line, $v = 0$, in the w-plane is mapped onto the x-axis in the z-plane. Thus ϕ does vanish on the x-axis.

2. As a function of z and z_0, ϕ is the Green's function for the Dirichlet problem in the upper-half plane.

3. The potential ϕ has a meaning in fluid dynamics. It corresponds to the potential due to a source at z_0 and a sink at $\bar{z}_0$.

4. The potential ϕ has another electrostatic interpretation. It is the potential due to a line charge at z_0, in the presence of a grounded "infinite" conducting plate on the x-axis.



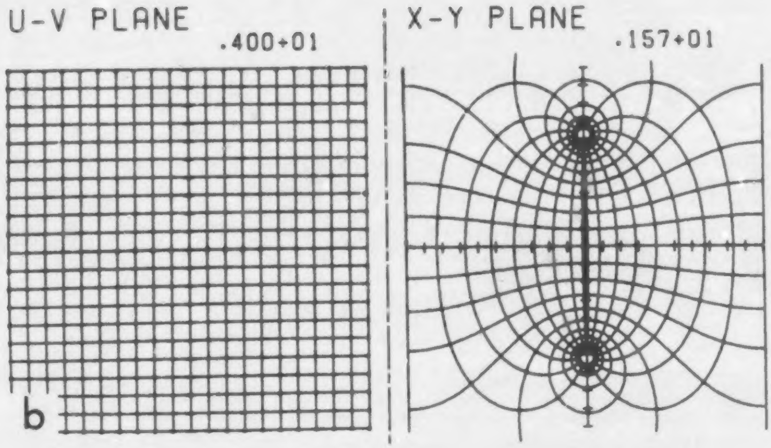


FIG. 10a. The dipole constructed with transformation (18).

FIG. 10b. Currents in a house-wall constructed with transformation (24).

The Dipole: If we allow z_0 to approach the origin in the above example and at the same time adjust the charges so that the dipole moment remains constant, then we can derive **[16]** the complex potential for the dipole

$$F(z) = 1/z. \tag{18}$$

This is an especially easy function to invert and construct the equipotential lines as shown in Fig. 10(a).

Currents in a house-wall: As a final example in electricity, we shall construct the equipotential and current flow lines in an idealized conducting house-wall containing a positive and negative line source in the interior of the wall [17]. Again we assume the wall is infinitely high so we can reduce the problem to a two-dimensional one. This problem is similar to the line charge and conductor problem illustrated in Fig. 9 with the added condition that all flow lines are confined to an infinite slab parallel to the y axis. Mathematically this means that the normal derivative of the potential must vanish at the surface of the walls. This condition is achieved through an application of the method of images which places unit charges periodically along two lines parallel to the x-axis. Assuming a wall width of π and line charges at i and $-i$, the complex potential in the house wall becomes

$$F(z) = \log \frac{\sin(z-i)}{\sin(z+i)}. \tag{19}$$

To construct the equipotential lines and the lines of flow, we must once again invert the potential. First translate (19) into exponential form

$$e^w = \frac{\sin(z-i)}{\sin(z+i)}, \tag{20}$$

where $w = F(z)$. Next, use the trigonometric identity

$$\sin(z \pm i) = \sin(z)\cos(i) \pm \cos(z)\sin(i) \tag{21}$$

to expand and rewrite (20). Finally, collect like terms and divide through by $\cos(z)$ to get

$$\tan z = \tan(i) \cdot \frac{1+e^w}{1-e^w} \tag{22}$$

which is easily inverted to

$$z = \arctan\left(\tan(i) \cdot \frac{1+e^w}{1-e^w}\right). \tag{23}$$

This function can be expressed with complex logarithms as

$$z = 1.32 \log \tfrac{1}{2}\left(e^w + (e^{2w} + 4i)^{\frac{1}{2}}\right). \tag{24}$$

Using equation (24) in our graphics program, we can easily construct the level curves for the potential inside a house-wall as shown in Fig. 10(b).

Again the potential that we have investigated is a Green's function. Specifically, the real potential

$$\phi(z, i) = \frac{1}{2\pi} \log \left| \frac{\sin(z-i)}{\sin(z+i)} \right| \tag{25}$$

is the Green's function at $z_0 = i$ for the infinite well $-\pi/2 \leqq x \leqq \pi/2$, $y \geqq 0$ under the mixed Dirichlet and Neumann boundary conditions

$$\phi = 0 \text{ on the } x\text{-axis, } y = 0, \ \partial\phi/\partial n = 0 \text{ on the walls } x = \pi/2 \text{ and } x = -\pi/2. \tag{26}$$

A MATHEMATICAL APPLICATION: STEINER'S THEOREM. Our emphasis in this paper has been on the applications of conformal mapping rather than on the study of conformal maps themselves. It should be obvious, however, that one can use a graphics program to develop intuition about the behavior of a large variety of complex analytic functions or illustrate properties of conformal maps. Branch cuts, which are often bewildering to the beginning student, exist throughout our investigations of inverse mappings. When we cross a branch cut for a mapping on the graphics terminal, the result is dramatic. An extraneous line appears in the image of the mapping that connects the jump discontinuity associated with every cut. Consequently, branch cuts are easy to illustrate on the graphics terminal, although occasionally a nuisance if not avoided. For example, most of the equipotential curves for the current in a house-wall had to be constructed by two vertical line segments which carefully avoid crossing the branch cut on the x-axis.

For the versatility necessary to study conformal maps, we have built into our program the ability to generate the images of more than just horizontal and vertical lines. The option of transforming circles permits us to reconstruct a proof of Steiner's Theorem.

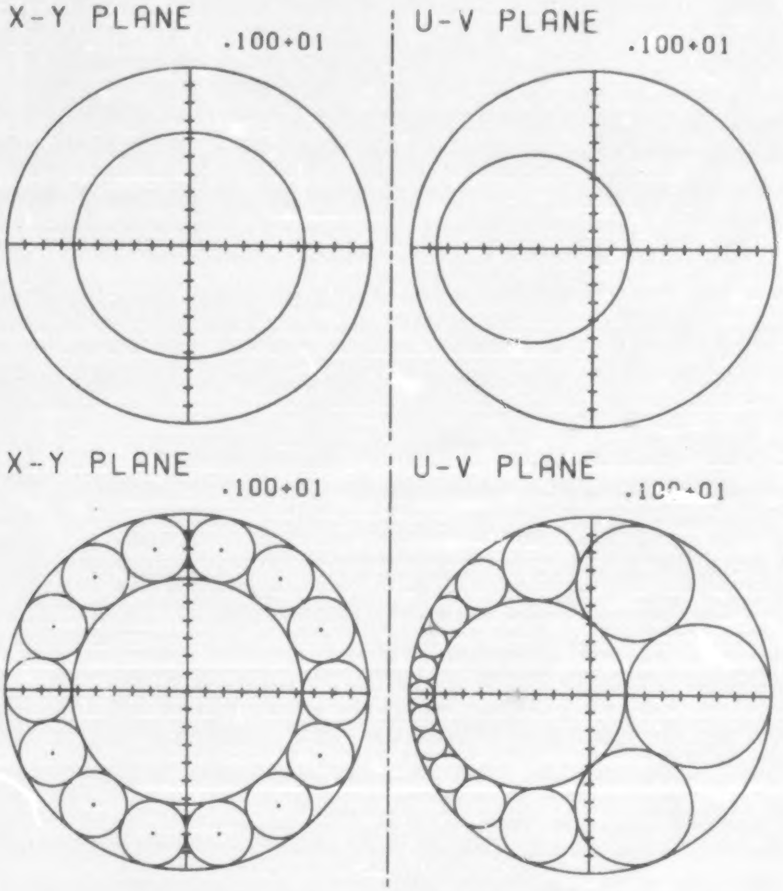


FIG. 11. The bilinear mapping (27) with $a = .5$.

Steiner's Theorem: Draw two circles in the plane, one inside the other, and draw other circles tangent to them and to one another as shown in Fig. 11. Sometimes the ring of circles fit snugly together like a set of ball bearings and the last circle is tangent to the first one. It would be natural to expect that some arrangements fit perfectly while others do not, depending upon where you place your first circle. However, Steiner's theorem contradicts our intuition and states that the ring of circles will fit perfectly for *every* position of the starting circle if it fits for *any* position of the starting circle [**18**].

The proof of Steiner's theorem using conformal mapping can be demonstrated with our program. First, we must construct a conformal mapping that transforms the region between the two non-concentric circles onto an annular region. This is always possible [**19**] and the mapping is bilinear

$$z = \frac{a - w}{aw - 1}, \tag{27}$$

where $-1 < a < 1$. Since bilinear maps transform circles and lines into circles and lines, the ring of circles shown on the right in Fig. 11 is transformed into a ring of circles of uniform diameter inside the annulus. Of course, for the annulus, the position of the first circle has no effect on whether the circles fit snugly or not and Steiner's theorem is completely obvious. Thus, the theorem must hold for arbitrary nested circles.

Conclusion. Several educational benefits resulted from using computer graphics to construct conformal mappings. The exercise of writing the program was a significant educational experience and was done as a project in an undergraduate course on computer graphics **[20]**. Finding complex potentials associated with applied problems and computing their inverses was also a worthwhile exercise. The graphics program was used in class in an interactive mode to examine properties of individual conformal mappings. Finally, a video tape of the most interesting mappings was made for use independent of the computer and future reference **[21]**.

Acknowledgment. We wish to thank Professor B. Greenebaum and C. J. Goebel for critically reading the manuscript and making several helpful suggestions.

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21. The videocassette *Application of Conformal Mapping* is available through the Media Production Center, UW-Parkside, Kenosha, Wisconsin 53141.

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Prepared by:

Dr. Jeannie Ireland
Department of Home Economics
Illinois State University
Normal, IL 61761

MICROCOMPUTERS IN HOME ECONOMICS

Dixie Porter Jackson
Extension Specialist
Consumer Economics
Purdue University

INTRODUCTION

Microcomputers are a part of our lives today, professionally and personally, and will be even more integrated into our lives in the future. I am doing this paper via word processing on a microcomputer. It is simply easier to do corrections and revisions. One of my jobs as a specialist is to update our computerized budget programs with the latest Consumer Price Index. And we are now in the process of creating several programs that are much more complex than any Home Economics program on our computer system to date. We can also use our computer system to communicate with county extension offices.

Although the computer is not an end in itself, it is and will be the means to many goals. Some of these goals are a part of the area of Home Economics. The purpose of this paper is to give the reader some "food for thought" about the possible uses of the microcomputer in Home Economics. I do not have experience in vocational education, but hopefully the information will generate ideas for your own use.

Microcomputers and Women

A recent article in Business Week suggests that very few young girls, relative to young boys, are entering voluntary computer classes or camps. If this observation is true, we may have a future generation of women who are not able to compete for many jobs and careers that involve computers. Even if the problem is short-term, I am tired of short term problems that have long term impact on women.

A majority of Home Economics professionals are women - women teaching women. There are men in Home Economics, but it is still predominantly female. I see it as our repsonsibility to gain computer expertise and pass that competency, and hopefully seeds of interest, on to our students.

Microcomputers and Education

Microcomputers offer a number of advantages in education that are appropriate for Home Economics and vocational education specifically.

- Microcomputers allow for self-paced learning. Students are able to use the computer programs as their time schedule and learning rate allow.
- Students get instant feedback without constant supervision.
- More sophisticated programs can allow students to participate in content specific applications activities, with interactive simulation possible.

Drill and practice programs can provide the student with practice in learning basic terms, definitions, formulas and relationships. The drills can be adjusted to degree of difficulty and students receive instant feedback.

Other programs can serve a tutorial role. The user is usually given some information and then asked a set of questions about the content. If the answers are correct, the computer moves on to the next section. If not, the student is allowed to review the material and answer questions again.

The third educational role is problem solving. Real life situations are presented, allowing the student to apply information learned via tutorial and drill and practice programs. An example of such a program would be one where information about a small restaurant is presented and several problems are presented. Students might be able to request specific information needed for problem solving, make cost adjustments, etc., with the program analyzing the impact of their decisions on the business.

Subject Matter Applications

The comments that follow summarize computer programs that exist now in Home Economics or that could exist shortly. Most of the programs' ultimate users are consumers, although applications of these ideas may be useful in vocational education.

Family Resource Management

Many individuals and family units do very little record keeping or financial analysis. One reason for this is the time and complexity involved. Programs now exist that allow families to compare their expenditures to expenditures of the "average" family of same age/sex/number structure. These programs make a good starting point for discussion and examination of how families are currently allocating or wish to allocate dollars. General record keeping and tax records can be done on the computer as well as the analysis of investments. Such programs can encourage families to take their tax bracket, any compounding differences, etc. into consideration - things they may not do if left to paper and pencil. Periodic net worth statements can be generated.

As programs and equipment improve, more complicated resource management questions can be explored. Projections into the future, using some assumptions, can be done. Individuals and family units will be able to estimate retirement needs and the savings program necessary to meet those needs. Family income/expenditure projections can be made that consider the entrance/exit of members (e.g. the birth of a child) into the family unit and the entrance/exit of members in the labor force. The impact of assumed cost-of-living changes can be personalized for individual families.

Housing

Energy programs now in use allow consumers to input information on existing structures and price of energy. Cost effective energy saving procedures are then suggested by the program. Amortization programs allow consumers to change variables (purchase cost, term, down payment, interest rate) and get in return a printout showing monthly payment breakdowns, total cost of the contract and total interest costs. Most programs in existence do not yet allow the flexibility necessary for creative financing and alternative mortgages. Given the housing mortgage market, there is a great need for such consumer-oriented programs and they will be produced in the next year or two. Such programs need to have assumptions concerning tax benefits, inflation trends and housing costs over time.

For most families the purchase of a home is the major purchase. Given the decline in traditional mortgages, and the flexibility built into alternative financing, computer projections may help families envision the impact today's housing decisions and tomorrow's economic trends may have on their economic well being.

The possibilities for use of the micro and mini computer in housing, household equipment and interior design are almost limitless. I will leave a detailed discussion for someone in those specialities.

Family Development

I do not believe that life cycle development programs exist at this time. But, it is easy to envision at least drill and practice and tutorial programs in the area. Such programs could be geared towards students who will be employed in child care facilities and care facilities for the elderly. These programs could also be geared toward use by families. I can see monthly and then semi-annual lessons on child development for parents via use on a home computer.

Family interaction may seem far removed from the computer and yet the use of case studies and problem solving can be very useful in getting family members to consider, discuss and evaluate their own family unit. It is sometimes difficult for individuals to identify their values and priorities, let alone what other family members want. And, ultimately, coming to some kind of consensus on values and goals is what family resource management is all about.

Foods and Nutrition

Programs now exist that estimate average food expenditures for families, updated by the CPI and adjusted for family composition. Some programs will list specific content (sodium, iron, cholesterol, etc.) of foods. Programs may also evaluate actual diets (calories intake, sodium, cholesterol, etc.). Programs may also create menus, based on certain needs (e.g. low sodium), calorie limit, and food preferences. Low cost menu planning, based upon local and/or seasonal specials, could also be done.

Clothing and Textiles

Stain removal programs now exist that allow individuals a quick answer to specific stain problems. Other programs estimate 'average' clothing budgets for families, considering the age/sex/number of family members. Clothing selection based on certain individual characteristics can also be done on computer. The use of microcomputers in the area of clothing construction has great possibilities - computerized pattern alterations and original pattern design.

Summary

In our own use of microcomputers, word processing and self-teaching packets are marvelous resources. Updating our papers and lessons, updating our statistical skills, doing form letters or revisions of papers - microcomputers can facilitate many aspects of our professional role.

As Home Economists, microcomputers help us with educational programs for students in a classroom setting or for family use in the home. Microcomputer programs can serve the drill/practice role, a tutorial role and application role. Programs serving these roles are applicable to all subject matter areas within Home Economics. It is the responsibility of the Home Economics professional to educate him/herself and serve as leader and role model for Home Economics students.

Industrial Education

An Analysis of Problems Encountered In Implementing Microcomputers In Secondary Education

William A. Estrem
Department of Educational Administration and Foundations
Illinois State University

Running Head:Pitfalls in CAI

An Analysis of Problems Encountered In Implementing Microcomputers In Secondary Education

1. Problem Statement

In recent years the number of schools using computers for instructional purposes has increased explosively. This phenomena can be attributed to the entry of the microcomputer into the marketplace, with price tags that fit nearly all pocketbooks or school budgets while providing the basic computing power of earlier mainframe computers.

As schools rush in to this new market many of those who are selecting the equipment and courseware find an array of technical issues that leave them confused and bewildered. Even after the hardware has been purchased, the educator who attempts to integrate the microcomputer into their instructional repetoire find a variety of obstacles strewn along the way.

Purpose

If educators are to maintain any semblance of parity with the technological advances the computer has brought to society, then the computer must become an integral part of the school curriculum. As with any attempted innovation in the "traditional" curriculum there is a honeymoon phase (which appears to be appearing now) followed all to often by disillusionment and the return to the traditional methods. It is the hope of this researcher that this study and others like it may identify problems that schools are encountering and offer realistic solutions where possible so as to ensure that Computer Based Instruction does not go the way of so many oher promising innovations

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Need

It is hoped that this study may assist educators who are preparing to implement a microcomputer program at their school by suggesting areas that should recieve special consideration during the planning stages. Furthermore, this study may offer insights for educators who already using the microcomputer.

Research Questions

This study will focus on identifying the problems schools are having during the implementation of microcomputer based instruction, and the effects these problems have on program success as viewed by administrators and faculty. It will also focus on examining the length of time schools have been using microcomputers, and how they are being used.

Using data collected from the sample schools the following research questions will be analysed:

1. What percentages of schools in the sample are using microcomputers for instructional purposes?
2. What relationship is there between school size and microcomputer use?
3. What academic areas are microcomputers being used in?
4. Is there a relationship between the number of microcomputers and the percieved program success?
5. To what extent have the potential problems affected the percieved program success?

Limitations

This study was conducted as a pilot study using a universe of 50 secondary schools. Since several schools had not implemented microcomputers into their curriculum, the significance tests of various inferential statistical procedures in this study are affected by the small sample size.

Nevertheless, the .05 alpha level will be the probability limit for all significance testing. Where appropriate the critical values and probabilities for statistically insignificant relationships will be displayed.

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Review of the Literature

Modern computer technology has made it possible for schools to use computers in the teaching process for quite some time. Traditionally, the computer has had two major applications in the classroom, Computer Assisted Instruction (CAI) and Computer Managed Instruction (CMI). CAI has been used in many ways which can be broken down into 5 basic catagories:

1. Tutorial - an instructional episode which provides branching within the program for remedial work.
2. Drill & Practice - a repetitive sequence of problems.
3. Simulation - manipulating a phenomena or its environment in order to observe what outcomes occur.
4. Problem Solving - learner uses the computer as a research tool to solve problems.
5. Instructional Games - uses individual decisions and competition over some limited commodity.

(Dennis, 1979, 4)

> In CMI " the role of the computer is to control and to expedite the "traffic" during instruction. In doing this, the computer assumes responsibility for tasks such as: diagnosing, assigning, routing through curriculum, communication among members of the instructional setting, controlling resource utilization, progress evaluation and related record keeping."(Dennis, 5)

Until recently, the use of these methods has been limited by the expense of using large mainframe computers, and by the "unfriendly" languages used to program them. Several of these mainframe systems were dedicated to educational computing applications with schools buying access time on remote terminals. But, even with this timesharing approach the vast majority of schools could not justify the expense required to participate in such networks. For example, in the sixties and seventies Control Data Corporation in cooperation with the Computer Education Resource Lab (CERL) at the University of Illinois developed the PLATO system (Programmed Logic for Automated Tutorial Operations). This system has over 30,000 hours of CAI courseware available to its users through especially designed interactive graphic/audio/visual terminals placed at thousands of sites around the world. Howaver, the fully equipped terminals cost nearly $10,000.00 which is clearly beyond the price range that most schools can afford. But, since 1975 the microcomputer has been offering similar potentials to educators for a fraction of the cost. Today, for around $200.00 schools as well as individuals can purchase a microcomputer (not including monitors ect.). For those who wish there are systems that can cost several thousand dollars. The typical systems used in schools range from $500.00 to $2500.00.

A recent survey by the Dept. of Education reported that one in four schools are now using microcomputers for student use. (Zucker,317) From all indications this number will continue to grow geometrically in the near future.

However, as schools acquire the "hardware" they are experiencing a multitude of problems that restrain CAI from attaining its full potential in education. Osborne points out that "CAI has been around for a long time, yet I doubt if there is any place where the computer has offered so much potential and delivered so little product".(Osborne,91) A.S. Melmed lists the following factors which he feels will delay the full use of of CAI by as much as 20 years:

1. Budgets that do not allow sufficient money to purchase enough micro computers.
2. Poor Courseware availability.
3. Lack of current investment in developing new approachs to student uses of computers

(Melmed,308)

As the number of microcomputers continues to grow, one of the most onerous

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problems that educators encounter will be the lack of quality courseware in a courseware driven market. At this time, the majority of teachers must rely on coursewares that are either purchased from commercial sources, obtained through educational courseware consortiums or users groups, or "pirated" from copies that have been acquired by other colleagues. Even with these resources it is still difficult to obtain courseware of good quality with sufficient documentation to enable the user to maximize its use. The EPIE Institute which serves as a consumers guide to educational technologies has identified the following list of barriers to te development of quality courseware:

1. The dependency of teachers on instructional materials.
2. The low priority given to courseware selection by administrators.
3. A lack of awareness on the part of educators of their clout in the courseware market.
4. Long established patterns of buying the latest hardware, and then hastily selecting courseware to justify the equipment without discrimination.

(EPIEgram, Dec 1981)

Others in the courseware field have felt that educators are not good consumers that they are simply willing to accept what is offered to them. Most of the courseware today is based on a "traditional" drill and practice format which does not take full advantage of the interactive nature of the computer. (EPIEgram, Dec 1981)

Those educators who have undertaken the task of developing their owncourseware have more than likely found it to be a time consuming task which although it may be an enjoyable activity, is one with few external rewards. Finding the time to develop, debug, and to test courseware is difficult for even the most addicted of all CAI enthusiasts.

The problems related to the hardware itself are comparatively straight forward after examining courseware issues. The greatest problem being the lack of funds to purchase sufficient units to allow one on one interactions in the

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classroom setting. With only one or two units in a classroom the educator finds that he /she is doing two things at once, supervising the students who are currently operating CAI materials, and using traditional methods with the remainder of the class.

The hardware itself is very reliable, and in the event of failure the manufacturer may even offer the use of a loaner unit for the duration of repairs. In most cases a user must work diligently to cause a malfunction to occur.

Each of the commonly available microcomputers have their own peculiar "unfriendly" characteristics such as, hypersensitive volume levels on tape recorders used to load and unload programs, or a lack of "warm start" capability in the event an error is encountered during program execution which forces the user to reload the program and start over at the beginning of the program. At the present time these problems can severely interupt a CAI session, but as newer systems replace the original systems many of these "glitchs" seem to be corrected.

With the basic microcomputers used by most schools program security is becoming more of a problem because these units normally do not have any built in security functions (passwords) to prevent the sophisticated student from listing CAI programs to find out ways of circumventing their logic. As more and more students become sophisticated in the use of microcomputers, security will become an issue which must be addressed. However, even the mainframe computers with several levels of security have fallen victim to the creative but devious programmer.

All of these courseware and hardware issues can be attributed to the human element. While the machine and its programming are not perfect, the weakest link in CAI is the way that people interact or do not interact with

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the microcomputer. Students are typically enthusiastic about CAI although some educators fear that "as computers become commonplace they may become boring or dull."(Brents,1980,17) Still others are concerned that the excessive use of CAI may cause regressive social behavior, or that administrators might abuse CAI as some abused closed circuit TV by expanding class sizes,(Craft,1982) or that lazy teachers might use CAI as some depend on "an endless parade of films with no student-teacher dialogue.(Craft,27) As CAI courseware continues to grow and hopefully improve, it should be able to keep the interest of the student, but CAI has never been advocated as a surrogate teacher for any extended period time. The key word is Computer Assisted Instruction.

Perhaps the weakest of all the links in CAI at this time is the faculty Most educators who are currently teaching have had little or no exposure to computer technologies in their academic preparation In a study of higher education faculty towards CAI, Hausman found the following rank ordered reasons for not using CAI in instructon.

32% 1. Lack of training.

22% 2. Lack of equipment.

12% 3. Lack of time.

11% 4. Lack of interest.

10% 5. No application.

(Hausman,1979,13)

Presently there is a multitude of training activities underway to correct this problem and as new teachers who have recieved training in CAI as part of their preparation enter the field this problem should eventually become minimized. However, as more and more educators become familiar with CAI the demand for money to purchase more hardware and software will place a heavier burden on school budgets that are already under considerable stress.

If these dollars are to be well spent on successful CAI programs,

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administration must also consider allowing participating faculty a reasonable amount of release time to establish the program. The time required to author and test courseware is often beyond what can reasonably be expected of a dedicated educator during the school year when considerable demands are placed on his/her "free time" outside of the classroom.

In this study, the researcher set out to acquire data describing the uses of CAI in secondary schools within a small sample area. The following sections of this report will analyse the data obtained from the respondents and offer recomenations based on that data which may benefit schools who desire to employ CAI in their curriculums.

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III Research Design and Procedures

Universe and Sample

This survey was intended as a pilot study to ascertain the need for further study of this nature. It was conducted during the Summer of 1982, and had to be completed in a short period of time. Therefore, the researcher selected a small universe of 50 secondary schools which contained a broad range of school sizes.

Sampling Technique

Because of the brief amount of time that was available, the researcher used telephone interviews to gather the data. Several attempts were made to reach an administrator or knowledgeable member of the faculty at each of the 50 schools. It was not possible to reach some of the schools at all and in others the respondant was not qualified to offer any information beyond basic descriptive data about their schools use of microcomputers.

Instrument

The instrument used for this study is to be found in appendix A. It consists of two main parts. Part I itemises descriptive information pertaining to the school's use of microcomputers. If the school has not used microcomputers at this time no further information was gathered. The descriptive information found in Part I indicates the source of the data, the size of the school, whether or not the school has used microcomputers, for how long, in what academic areas is it being used, and the number of systems, their make and types of peripheral equipment attached.

Part II of the survey uses variables with Likert scales to gather data pertaining to the respondent's attitudes about the success of the school's CAI program and the magnitudes of various problem areas previously selected by the researcher.

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Analysis Techniques

The first phase of the analysis of the data involved the compilation of descriptive data. This data base was then processed using the Frequencies subprogram of the Statistical Package for the Social Sciences version X (SPSS) running in an IBM 370 environment. In the second phase, various selected relationships between variables in the data base were examined using the Crosstabs subprogram (SPSS). In the third phase, selected relationships between variables in the data base were tested using multiple regression analysis in order to attempt to explain how the various independent variables such as school size,number of systems,and the problem issues,affected the criterion variable-perception of success. Included in the regression analysis were various ancillary procedures such as Pearson Product Moment Correlation and residuals analysis. The theoretical framework for the regression analysis was derived from research questions 4 and 5 in section 1 Each of these questions appears below stated as a null hypothesis.

1. Ho : There is no relationship between the number of microcomputers and program success as percieved by the respondent.

2. Ho : There is no relationship between the potential problems the district has encountered and program success.(both terms as percieved by the respondent)

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IV. Presentation and Analysis of Findings

Phase I

Schools sizes in the sample ranged from a low of 52 to a high of 1550. The school sizes were distributed as indicated in figure A. The distribution was not normal, but expected for this region with its heavy industrial centers and extensive agricultural land use.

Respondents to the study ranged from Superintendents to Bookkeepers. The data used for regression analysis was restricted to information acquired from administrators and informed faculty.Out of the total useable sample only 15.4% reported that they were not using microcomputers at tis time. Many of those indicated that equipment was on order, and that they would begin using the equipment in the coming school year. For those schools which did report using microcomputers, a table showing areas they were used in is shown in Figure B.

The schools that are using microcomputers in this study were primarily using them to teach computer literacy and programming. The other academic areas in which microcomputers were actually being used for CAI were in rank order:

1. Business
2. Math
3. Science
4. Agriculture/Industrial Arts (tied)
5. Other(media center,special education,home economics)

Of the schools responding that they were using microcomputers, 56.7% were using AppleII systems, while TRS80 models I&III accounted for 40% of the sample and Commodore Pet accounted for 3.3%. Other specialized systems for Word Processing and administrative uses were not included in the tally. Although peripheral equipment can often exceed the cost of the basic machines 93% of the using respondents reported using floppy disk storage, and 90% reported having at least one printer available for their systems. The number

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of systems per school ranged from 1 to 9 units with a mean of 4.2 units.

The five variables designed to measure program success as percievd by the respondent were coded using a Likert scale. The values along the 5 point scale were coded as follows:

(1) strongly agree
(2) agree
(3) no opinion
(4) disagree
(5) strongly disagree

The five questions (appendix A) had means that ranged from 1.133 to 2.067 With the exception of A3 the third of these variables the means and the variances did not change a great deal. This may indicate that the questions themselves were not stringent enough to measure adequately the degree of program success, or that the respondents are on the whole pleased with the progress that is being made in their CAI program. Variable A3 dealt with teacher acceptance of CAI as percieved by the respondent. At this time, the faculty is a major weakness in the implementation process which may account for some of this variation. In subsequent regression analyses all five of these variables were combined into a composite score which was the mean of the variables.

The remaining variables are aimed at identifying the problems that the responding schools are having with their programs. They are broken down into six main issues; Student issues, Faculty issues, Administrative issues, Curriculum issues, Hardware issues and Software issues. Each variable was coded as being (1) no problem (2) somewhat of a problem and (3) major problem A rank ordering of the 19 problem variables in Figure C. reveals that faculty related issues and software related issues are the predominant problems that schools are encountering in their CAI programs. Interestingly, both of the leading problems with faculty relate to the time and training requirements imposed on the faculty who become involved in CAI. In addition to the faculty and software issues, Capital costs and lack of funds to purchase quality software (if it is available) are perceived to be major factors inhibiting CAI program success. Student game playing is the only major student issue which may cause problems, but most respondents indicated that they were increasing their efforts to control this activity.

Clearly, these findings support observations noted in the review of the literature.

Phase II

In order to further examine the relationships between percentages of schools using microcomputers and school size, a contingency table of the variables Use and Size was generated using the SPSS Crosstabs subprogram. Figure D. This table had a Chi Square of 8.60526 with 6 degrees of freedom and a significance of .1970 . These figures indicate that the variables are statistically independent of each other. An examination of the table does not support this. While the larger schools do tend to have more microcomputers, the smaller schools in the sample seem to have more units than do the schools in the middle ranges. However, this effect can be attributed to the distribution of school sizes which is bimodal with the modes occuring at the high and low ends of the distribution. Perhaps a larger sample with more normalized distributions could demonstrate that a systematic relationship does exist between school size and the number of systems. In this study the researcher will accept the null hypothesis that there is no relationship between school size and number of units.

Phase III

In the final analysis, regression models were entered into the SPSS New Regression subprogram. These models were designed to test the relationship between the composite program success variable and various predictor variables. The first model entered regressed the perceived program success on the number of systems. Listed below is a summary of that model:

Model: Predicted Program Success= A + B(N of Systems)

Multiple R = .08147 R square = .00664 F = .18709 Sig. = .6687
Contant =1.42688 B =-.01099

Clearly, this model will not be useful in explaining the criterion variable. Factors that may contribute to the failure of this model to significantly aid in the prediction of program success are first the small sample size and second, specification errors centering around the omission of relevant variables from the model. For this model the researcher accepts the null hypothesis. Approaching the theoretical model from a slightly different approach by regressing program success on the number of years yielded a much better result although it too was not significant at the .05 level.

Model: Predicted Program Success = A + B(Years)

Multiple R = .31956 R square = .10212 F =3.18443 Sig. = .0852
Constant =1.55733 B =-.07823

While this model is not significant at the .05 level it is close enough in the context of this pilot study to be discussed. The equation indicates that as the number of years that a school has used microcomputers increases the percieved program success also increases. This could be attributed to the resolution of some of the problems that face the neophyte school as they begin the implementation process. As more software and hardware is accumulated and more faculty become competent with the technology, it would seem logical to expect an increase in the percieved program success.

The last research question examines the relationship between the respondent's perception of program success and the intensity of the problems examined within the six catagories of the survey instrument. The theoretical model called for regressing perception of success on all six of the composite scores of problem intensity. The results of this first analysis were:

```
Model:   Predicted Program Success = A + b1(student) + b2(faculty) + b3(admin)
                                     + b4(curric.) + b5(hdw) + b6(software)

Multiple R = .33532      R square = .11244        F = .48564   Sig. = .8122
Constant   = .93485

 B(student) = .262
 B(faculty) = .018
 B(admin. ) = .142
 B(curric.) = .111
 B(hdware.) = .158
 B(sofwre.) = .127
```

This model obviously did not perform well in explaining the relationship in question. However, that is not to say that with a larger sample it might not. It could also be presumed that the high correlation between the independent variables as well as the variables used to construct the composite dependent variable could also explain this effect. In order to test this supposition the researcher examined another multiple regresrion model that closely followed the principal model for this research question. In this model, the third variable of the five used to make up the criterion vriable composite was regressed on the individual variables used to construct the original composite predictor variables. Only those individual variables which correlated highly with the criterion variable were included. For those predictor variables which were highly correlated, interaction variables were computed and included in the model. The results of this test were:

```
Model:   Predicted Teacher Acceptance of CAI = A + b1(years using) + b2(soft3)
                                               b3(fac1) + b4(fac3) + b5(soft4)
                                               b6(st4 * so4) + b7(years * ta3)
                                               b8(fac1 * so4) + b9(fa3 * so4 )
                                               b10(so3 *so4)

Multiple R = .89675      R square = .80416        F = 7.80182  Sig.= .0001
Constant   = .99960
```

(analysis continued)

B(Year) = .186
B(Software3 = .595
B(Faculty1 = .412
B(Faculty3 =1.299
B(Software4 = .927
B(Year,Faculty3) =-.154
B(Faculty1,Softwr4)= .144
B(Faculty3,Softwr4)=-.299
B(Softwr3,Softwr4) = .097

This analysis shows a significant relationship between the various predictors and their interaction terms and the criterion. The main reason that variable 3 was selected out of the composite was its broader range of responses compared to the other criterion composite group. The researcher speculated that the members of this variable group were not sensitive enough indicators of percieved program success. It is true that administrators and other respondents to this survey may have simply been quite favorable in their attitudes towards CAI, but in subsequent studies a more stringent test of such attitude should be applied. The inclusion of interaction terms between the highly correlated predictors, and the exclusion of variables that do not correlate highly with the criterion does improve the ability of the general model to explain the criterion. However, since only two of the regression coefficients had significant T values this researcher is hesitant to make generalized inferences to the population.

Conclusions and Recommendations

Conclusions

It is apparent that many schools are now using microcomputers for various types of instructional purposes. The number of school using such methods is increasing rapidly and schools that are using such equipment now are continuing to expand their programs. As this process continues the major problems that will face educators are going to be the lack of quality training available to educators, lack of time to develop courseware, the lack of funds to purchase sufficient equipment to properly operate CAI instruction, a lack of quality courseware that make full use of the capabilities of the microcomputer, and reticent faculty who will reject CAI because they are not willing to take the time learn the basic skill involved in using it.

As time passes the problems that appear in the initial implementation stages do seem to abate. Augmenting this effect will be the continued improvement of hardware systems and hopefully the development of high quality interactive courseware. Within the educational community, participation in Users' Groups and the use of state supported clearinghouses will greatly increase the utility of equipment already in place. However, some schools may experience new problems because, on the horizon is a new breed of microcomputers with tremendous power compared to the present "8 bit" systems. Some of these "16" and "32" bit machines that are now appearing on the market are descendents of the old "8 bit" machines, which makes it possible for some of them to be "downward compatible" with the older machines. But, with the appearance of these new machines a great deal of the existing software and hardware will become obsolete. For schools who are already heavily invested with older microcomputers this may cause problems. Even if they are able to use the new machines with their old courseware, the machines will behave as if they were only "8 bit" machines.

The final area of concern relates to the propensity of students to use the computer to play games. Whether or not this is a problem depends on the philosophy of the educator and the magnitude of the "problem". Students enjoy the various gaming activities which the computer may provide them. Often these games can have tremendous teaching potential. Used with prudence these games can be a positive influence on the curriculum and can perhaps awaken the latent potentials in some students who are not particularly compatible with more conventional approachs to learning. Perhaps the main problem with games is not a pedagogical one but one of community relations. This problem was alluded to by several of the respondents in the survey. They seemed to feel that rumors circulating in their community about students using such expensive equipment for recreational purposes was raising the ire of the taxpayers This perception should be addressed and explained to the community.

Finally, in considering the relationship between the microcomputer and students, this observer believes that faculty will have to make every effort to keep up with their students and to be prepared to gracefully step aside as some of them far exceed the expectations and capabilities of the teacher. This condition is indicative of learning taking place and is something that should be a source of pride to the educator and the learner. It should not be squelched merely because it is enjoyable.

Recommendations for Further Study

This researcher recommends that this study be repeated with a larger sample size. Such a study should use an improved instrument that allows more efficient gathering of truthful descriptive data pertaining to applications, system configurations, district size and wealth, as well as more reliable indices of program success and intensity of problems. The study should use the same theoretical framework and basic research questions, but they should be analyzed in the context of a well defined causal theory.

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	N	%	Cu%
Less than 100	3	7.7	7.7
101-200	11	28.2	35.9
201-300	5	12.8	48.7
301-400	2	5.1	53.8
501-600	3	7.7	61.5
701-801	1	2.6	64.1
More than 800	14	35.9	100.0
Total	39	100.0	100.0

Figure A. - School Size Distribution

Application	Number of Programs
Computer Literacy	27
Programming	14
Business	20
Math	16
Science	10
Vocational Education	6
Special Education	1

Figure 8. - Application in Rank Order

Figure C. - Rank Order Listing of Problems Encountered

1. Lack of time for faculty to develop CAI materials.
2. Lack of faculty training.
3. Lack of faculty expertise to create in house software.
4. Capital costs for acquiring equipment.
5. Costs of purchasing quality software.
6. Lack of faculty expertise to debug or modify software.
7. Lack of relevant software.
8. Lack of faculty interest in using CAI.
9. Excessive recreational game playing.
10. Operating Costs for equipment.
11. Inappropriate method for teaching subject matter.
12. Untrained faculty feel threatened or obsolete.
13. Equipment obsolescence.
14. Incompatibility between systems of different makes.
15. Students losing direction or motivation in CAI curriculums.
16. Allocation of computer time between Instructional & Administrative Uses.
17. Equipment failure (downtime).
18. Lack of student interest.
19. Vandalism/theft.

	Use		
Size	No	Yes	Row Total
less than 100	2	1	3
101-200	1	10	11
201-300	0	5	5
301-400	0	2	2
501-600	1	2	3
701-800	0	1	1
more than 800	2	12	14
Column Total	6	33	39

Figure D. - Contingency Table School Size by Using Microcomputers

APPENDIX A

SURVEY INSTRUMENT
PITFALLS IN CAI IMPLEMENTATION IN SECONDARY SCHOOLS

I. Descriptive Information

School Name________________________

School Size________________________

Source Position____________________

II. Computer Applications

Has this district used computers for any type of CAI? Y N

If yes, how long has it been used?_____________

If yes, in what areas has it been employed? Circle areas:

MATH
FOR. LANGUAGES
BUSINESS
COMPUTER LIT.
SCIENCE
HEALTH/PE
HOME ECONOMICS
SCHEDULING
ENGLISH
AGRICULTURE
SPECIAL ED.
OTHER______________________
SOCIAL STUDIES
INDUSTRIAL ARTS
COUNSELING

COMPUTER SYSTEMS IN USE

NAME	MEM/SIZE	TAPE OR DISK	PRINTER (Y/N)	OTHER

III. Assessment of CAI Performance

Answer the following items by selecting the most proper choice:

SA A N D SD Students seem to learn a great deal from CAI units.

SA A N D SD Students seem to enjoy learning with CAI.

SA A N D SD Teachers in our district feel that CAI is an effective teaching tool.

SA A N D SD Our district will continue to use CAI.

SA A N D SD Overall, I believe CAI is a positive influence in education.

IV. Identification of Problems Associated with CAI

Rate each item according to this scale
1 no problem
2 somewhat of a problem
3 major problem

STUDENT ISSUES

- Game playing
- Vandalism
- Not interested
- Students lose direction with CAI

FACULTY ISSUES

- Not interested
- Threatens job sec
- Lack of training
- Lack of time to develop CAI programs

ADMINISTRATIVE ISSUES

- Capital costs
- Operating costs
- Allocation of time between instructional use and administration

CURRICULUM ISSUES

- Inappropriate method for teaching subject matter

HARDWARE ISSUES

- Downtime
- Rapid equipment obsolescence
- Incompatibility with other systems

SOFTWARE ISSUES

- Lack of relevant software
- Lack of funds to purchase quality software
- Lack of expertise to debug commercial software
- Lack of faculty expertise to create in-house software

V. Listing of Specific Problems Encountered with CAI

VI. Respondents Indicating No Present CAI Applications

Do you foresee CAE implementation for any programs at your school?

Yes No List programs if Yes If No list what reasons

MICROCOMPUTERS IN INDUSTRIAL EDUCATION

Leslie W. Alexander
Bloomington High School
August 13, 1982

Integration

There are three approaches to integrating the microcomputer into the industrial arts curriculum that will be discussed: simulation, computer assisted instruction and applications.

Simulations. Simulation is often referred to as "discovery" learning. An example is "Tycoon" which revolves around a manufacturing company in which the students exercise the role of manager and must make decisions based on identified variables such as volume to be produced, number of dollars to be spent on various advertising media, etc. Simulations provide the opportunity for students to make decisions, see the results of their decisions on the financial statements and, based on those results, make new decisions without suffering the financial consequences which occur in "real" life.

Computer Assisted Instruction. The second approach is computer assisted instruction. There are several examples of programs which are readily available at low cost for classroom use. "The Micrometer" is available from the Minnesota Educational Computer Consortium, 2520 Broadway Drive, St. Paul, MN 55113. "Fire Safety" is available from CLOAD Magazine, Box 1267, Goleta, CA 93017. The author is currently developing an application on "Table Saw Safety" to use with special needs students.

Applications. The third approach is through the integration of applications programs in the various courses in the industrial arts curriculum.

Curriculum Area	Title of Program	Source
Graphic Arts	Printing Cost Estimation	CPC*
Auto Mechanics	Auto Maintenance	CPC*
Metal	Metric Conversion and Bolt Selection Engine Lathe, Mill Drill Press Spur Gear Design	CPC
Construction	Building Construction Budget Estimation Stairway Design Electrical Service Entrance Calculations	CPC
Energy	Heat Loss Calculations Passive Solar Design	CPC
Electronics	Equivalent Volume Compliance Speaker Enclosure Design Speaker Crossover-Network Design Capacitance Calculation Transistor Switching Circuit Design Tuned Circuit Analysis	CPC
Wood	Wood Project Cost Estimation Board Feet Calculation	CPC
Drafting	CADAPPLE	T & W Systems 18437 Mt. Langley #B Fountain Valley, CA 92708

Classroom Management

Not only can the computer be used effectively to enhance the opportunity for learning but can also be an effective tool to aid the teacher in classroom management. For rapid access to student files, teachers can use a data base management program such as Profile (TRS-80) or DB Master

(Apple II). Visicalc is available for most microcomputers and can be used for applications such as project progress charts, record of fees, budgets, project planning, etc. Word Processing (Scripsit, Lazy Writer, Executive Secretary) can be used effectively for test construction, plans of procedure, course syllabi, and budgeting.

Results

Using the microcomputer in the industrial arts classroom results in highly motivated students, development of computer awareness, exploration of applications in selected careers, and accelerated learning.

*Curriculum Publications Clearinghouse
Western Illinois University
47 Horrabin Hall
Macomb, Illinois 61455

Programs available after June 1, 1982

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]RUN

3.3 DOS   APPLESOFT


THE IOWA DISK OF BASIC COMPUTER PROGRAMS


            INDUSTRIAL ARTS
SELECT FROM THE FOLLOWING:

   1. FRACTION PRACTICE
   2. MEASUREMENT DRILL
   3. LOAN AND INTEREST COST ANALYSI
   4. BREAK-EVEN POINT
   5. LAND SPEED RECORD ASSAULT VEHI
   6. RESISTOR COLOR DECODING
   7. OHM'S LAW PROGRAM
   8. BASIC ELECTRICITY TEST
   9. PROPERTIES OF A CIRCLE
  10. ENGINE TEST
  11. BOARD FEET
  12. STUDENT TEST PERCENTAGES


1) TO STOP HERE                        2) FOR MORE PROGRAMS
                  FOLLOWED BY <RTN>2
  13. AMPERAGES FOR THE ELECTRIC WEL
  14. FORMAT FOR A MATCHING QUIZ
  15. CAPACITIVE REACTANCE
  16. OHM'S/WATT'S LAW
  17. CAPACITANCE-RESISTANCE
  18. ROOF FRAMING
  19. CONSTRUCTION FRAMING ESTIMATIO
  20. SHEET METAL PROJECT COSTS
  21. COMMON MACHINE SHOP FORMULAS
  22. BUILDING HEAT LOSS
  23. CIRCUIT REQUIREMENTS FOR HOME
  24. MORE TEACHER PROGRAMS ('82 WKSHP)
  25. RETURN TO MENU START
  26. INTRODUCTION
  27. QUIT



NUMBER DESIRED FOLLOWED BY <RTN> 24
TEACHER PROGRAMS -'81 WORKSHOP

   1. FIGURING INTEREST
   2. TIME=MONEY
   3. ANTENNA SPECS
   4. ENERGY GRAPHS
   5. WOOD CHARACTERISTICS
   6. BASIC WOODWORKING TEST
   7. ABRASIVES
   8. RETURN TO MENU START
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To obtain a copy of this disk send a blank disk to:

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David H. Bechtel, M. S., Administrative Assistant
JAMES E. MITCHELL, Ph.D., DEPUTY SUPERINTENDENT

TO WHOM MAY BE INTERESTED:

We have 35 programs on a micro computer disk (applesolf). (DOS 3.3) This may be obtained by sending a blank disk to:

Harold Berryhill, Consultant
Department of Public Instruction
Career Education Division
Grimes State Office Building
Des Moines, IA 50319

(No charge)

Industrial Arts Publications -- These will be sold through:

Information and Publications
Department of Public Instruction
Grimes State Office Building
Des Moines, IA 50319

	The Iowa Guide for Curriculum Improvement in Industrial Arts, K-12, 1975	$2.00
	Iowa Industrial Arts Handbooks for:	
1.	Selected Aspects of Organization and Administration, 1979	2.00
2.	Introductory Level Graphic Communication, 1978 (stock temporarily depleted)	8.00
3.	Introductory Level Energy and Power, 1978 (stock temporarily depleted)	8.00
	Supplements for selected short courses, 1980 (stock temporarily depleted)	
a.	Model Rocketry (stock temporarily depleted)	2.00
b.	Alternative Energy Systems (stock temporarily depleted)	2.00
c.	Mechanical Conversion Systems (small engines). (stock temporarily depleted)	2.00
4.	Introductory Level Production (Manufacturing and Construction), 1980	8.00
5.	Computer Applications in Industrial Arts, 1981	2.00
6.	Elementary Industrial Arts/Career Education (90 Activities)	5.00

Marketing & Distributive Education

APPROACHES TO INTEGRATING THE MICROCOMPUTER INTO THE DISTRIBUTIVE EDUCATION CURRICULUM

MICROCOMPUTERS IN VOCATIONAL EDUCATION
SHERATON INN
MADISON, WISCONSIN
FRIDAY, AUGUST 13, 1982

PRESENTED BY
WILMA JEAN ALEXANDER, ED.D.
PROFESSOR
ILLINOIS STATE UNIVERSITY
NORMAL, IL 61761

APPROACHES TO INTEGRATING THE MICROCOMPUTER INTO THE DISTRIBUTIVE EDUCATION CURRICULUM

I. Importance of Using the Micro in Distributive Education

  A. 1990 - 90% of all jobs will be computer or computer-related - Infoworld
  B. Individualize instruction Interactive with computer

II. Modes of Learning

  A. Computer Literacy
  B. Skill Building
  C. Simulation
  D. Applications
  E. Programming
  F. Basic Skill Remediation
  G. Computer Assisted Instruction

III. Determining the Role of the Microcomputer in your Distributive Education Curricul

  A. Curriculum Review
  B. Literature Search - Magazines, software review, catalogs
  C. Professional Meeting
  D. Visit Schools
  E. User Groups

IV. Selection of Software
  Selection of Hardware

V. Support Considerations

  A. Personnel
  B. Systems
  C. Operations
  D. Administration
  E. Environment
  F. Continuing Costs

VI. Implementation

  A. Long - range
  B. Short - range

SOFTWARE - INTEGRATION OF MICROCOMPUTERS - DISTRIBUTIVE EDUCATION

Mode of Learning	Topic/Skill	Software
Simulation	Management	Lemonade Stand $25.00 Marketing Apple MECC-704 Creative Computing Software 39 E. Hanover Ave. Morris Plains, NJ 07950
		Cartels & Cutthroats Marketing Production Apple $40.00 Strategic Simulations 465 Fairchild Dr., Suite 103 Mountain View, CA 94043
		Conglomerates Collide Apple 48K Disk $39.95 Rockroy 7721 E. Gray Road Suite 103 Scottsdale, AZ 85260
		Management Decisions Apple & TRS-80 Hayden Book Company 50 Essex Street Rochelle Park, NJ 07662
		Market Marketing Apple, TRS-80 $25(MECC-704) $25(Eco & Social Siml) Creative Computing Software
		Micro Millionaire Marketing Production TRS-80 $9.95 Cassette $14.95 Disk Softside 6 South Street Milford, NH 03055

Mode of Learning	Topic/Skill	Software
Simulation		Oregon Trail Consumer Survival Minnesota Educational Computer Consortium 2520 Broadway Drive St. Paul, MN 55113
		Trader Series Simulations Apple II 48K 1 disk Stock Market Rainbow Marketware 3111 Berkshire Rd. Baltimore, MD 21214
Skill Building	Keyboarding	Hi-Res Master Type 48K Apple 1 disk $39.95 Lightning Software P.O. Box 11725 Palo Alto, CA 94306
		Typing Tutor II $24.95 MicroMountain 578 E. Ecko Ct. San Bernardino, CA 92404
		Typing Drill-Microtyping TRS-80 Hayden Book Co., Inc. 50 Essex Street Rochelle Park, NJ 07662
		MasterType $39.95 48K Apple disk Lightning Software P.O. Box 11725 Palo Alto, CA 94306
	Word Processing	Apple II
		Word Star (CP/M) $375.00 Z80 card 399.00 Mail Merge 99.00 Super Sort I 159.00 Spellstar 129.00 MicroPro
		Super-Text II $129.00 Alpha Byte Computer Products 31245 LaBaya Drive Westlake Village, CA 91362

Mode of Learning	Topic/Skill	Software
Skill Building	Word Processing	The Word Handler Silicon Valley 1625 El Camino Road Suite 4 Belmont, CA 94002
		Proofreader $129.00
		Grammatik $149.00 Aspen Software Co. P.O. Box 339-C Tyeras, NM 87059
		TRS-80
		Scripsit Word Processing (cassette) $39.95 Radio Shack
		Super Scripsit Model III $199.00 48K 1 disk Radio Shack
		Scripsit Dictionary 48K 2 disks $149.00 Radio Shack
		Lazy Writer $175.00 32K 1 disk SSM Marketing 6250 Middlebelt Garden City, MI 48135
		Proofreader $54.00 Grammatik $59.00 (Correction Option $30) Model I and III Aspen Software Co. P.O. Box 339-C Tyeras, NM 87059
	Layout	Apple Graphics Tablet $795
		VersaWriter $295 Peripherals Plus 39 E. Hanover Ave. Morris Plains, NJ 07950

Mode of Learning	Topic/Skill	Software
Skill Building	Communications	The Vocabulary Baseball Game 48K Apple 1 disk $24.95 J&S Software 140 Reed Avenue Port Washington, NY 11050
		Spelling Bee $39.95 Compu-Spell/Required Data Disk $29.95 6 Data Disk $19.95 Micro Mountain 518 Echo Ct. San Bernardino, CA 92404
		Capitalization $49.95 48K Apple II - disk Hartley Courseware, Inc. Box 431 Demondale, MI 48821
Computer Assisted Instruction	Programming	BASIC
		Creative Programming for Young Minds $9.95 per volume TRS-80, Apple, PET Creative Programming, Inc. 600 6th Street Charleston, IL 61920
		Microcomputer Workbook TRS-80, Apple, PET Sterling Swift Publishing Co. P.O. Box 188 Manchaca, TX 78652
		Step-By-Step $79.95 TRS-80, Apple, PET Program Design, Inc. 11 Idar Court Greenwich, Conn. 06830
	Communications	Sentence Diagramming $19.95 48K Apple 1 disk Avant-Garde Creations P.O. Box 30160 Eugene, OR 97403
		English Usage Exercise $149.95 48K TRS-80 2 disks 3R Software P.O. Box 3115 Jamaica, NY 11413

Mode of Learning	Topic/Skill	Software
Computer Assisted Instruction	Business Math	Metric System Tutor $59.00 48K Apple II disk Cygnus Software 8002 East Culver Mesa, AZ 85207
		Classroom Management System Mathematics B $595.00 48K Apple II plus and 48K Atari Science Research Associates 155 N. Wacher Drive Chicago, IL 60638
Applications	Accounting/ Record Keeping	Business Vol. 1 Diskette $9.00 Support Booklet $2.20 MICAS Vol. 1 Diskette $15.00 Support Booklet $8.00 Minnesota Educational Computer Consortium* Apple II 2520 Broadway Drive St. Paul, MN 55113
	Taxes	Tax Preparer $150 Apple II Howard Software Services 8008 Girard Avenue Suite 310 LaJolla, CA 92037
		Tax Manager $150/$30 per yr. Apple II 48K Micro Lab 2310 Skokie Valley Road Highland Park, IL 60035
	Records	Data Factory* $300 Apple II 48K Micro Lab 2310 Skokie Valley Road Highland Park, IL 60035
		DB Master* $184 Apple II plus 3.3 48K Stoneware Microcomputer Product 50 Belvedere San Rafael, CA 94901

* Available at discount from
The Discount Software Group, 6520 Selma Ave., Los Angeles, CA 90028

Mode of Learning	Topic/Skill	Software
Applications	Records	PFS $95.00 Personal Report System $95.00 Micro Mountain 518 E. Echo Ct. San Bernardino, CA 92404
		Guardian $199.95 Scheduling/Time Management 2,000 events/20 people TRS-80 Mod I/III; CP/M Time Management Software 123 E. Broadway Box 727 Cushing, OK 74023
Programming	COBOL	Radio Shack 48K 2 disks $199.00
	FORTRAN	Radio Shack 48K 2 disks $ 99.00
	COBOL	Microsoft 48K 2 disks $499.00
	FORTRAN	Microsoft 48K 2 disks $179.00
	BASIC	Introduction to BASIC $159.00 BASIC Programming $199.00 TRS-80 Radio Shack

FROM: David A. Howerton, ISBE/DAVTE

Marketing Competencies Involving the Use of (Micro)computers Peripherals and Software

ADVERTISING

Skill: In developing advertising layout and illustrations using stored information and the graphics capability of the (micro)computer and printer.

Knowledge of or Understanding that: How to advertise using electronic mail or voice mail and message systems.

Skill: In using (micro)computers to prepare an advertising budget and schedule of advertising.

Skill: In using on-line inventory management systems to verify the availability of merchandise in the quantity necessary to back-up an advertisement.

Skill: In using the (micro)computer for archival storage of advertising.

Skill: In using (micro)computer software to evaluate the effectiveness of advertising campaigns.

Skill: In maintaining customer/prospect or vender lists on (micro)computers.

Skill: In accessing data bases to identify new prospects.

Skill: In using (micro)computer models of populations to select market segmentation strategy.

Skill: Using data bases to retrieve information on special events in the life of customers to which personalized advertising can be directed. (e.g.: birthdays, anniversaries, weddings, funerals, graduations, etc.).

Skill: In using (micro)computers to keep informed about sales promotion activities in the store.

Skill: In using on-line inventory management systems to locate advertised merchandise in the store and to check on its availability.

Skill: In using (micro)computer printouts of advertised merchandise to spotcheck displays for refilling, rearrangement, or notifying sales force of dwindling supply.

Skill: In using an on-line inventory management system to check pricing and availability of merchandise in the store against competitors' advertised prices.

COMMUNICATIONS

Knowledge of or Understanding that: Existing forms and formats used for electronic data processing/information processing.

Knowledge of or Understanding that: Basic word processing concepts applied to business letter writing.

Knowledge of or Understanding that: Business communication style for electronic mail.

Knowledge of or Understanding that: Commercial communications networks used for electronic communications.

Skill: In using telephone modems to communicate from (micro)computer to (micro)computer.

Skill: In using data entry forms designed to list all information necessary for a customer data base to interview customers (tactfully).

Skill: Ability to explain the store's electronic data processing system/operations in non-technical language to co-workers, customers, and vendors.

Skill: In using the on-line inventory management system to spot trends in sales and in communicating this information to the selling staff.

Skill: In retrieving information stored in electronic data processing equipment to use in communications with customers or vendors.

Skill: In using the telephone as a medium for electronic communications (not including voice communications).

Skill: In applying electronic data processing concepts to marketing practices and developing a vocabulary descriptive of current practices in electronic data processing.

Skill: In customizing application software to the specific needs of the business using explanatory handbooks and software documentation.

Skill: In data entry for electronic equipment so that information to be processed is accurate.

Skill: In selecting and making any necessary modifications in form letters stored in word processing to communicate a message to a customer.

Skill: In writing (new) form letters to be placed into word processing for entry, storage, retrieval, updating, and reprinting.

Skill: In identifying out-of-date forms and formats to be purged from word processing.

Skill: In entering customer names, addresses, and other needed information into the (micro)computer for storage or to be able to retrieve information from the customer's or vendor's file.

Skill: In utilizing software dictionaries to check the accuracy of spelling in documents.

Skill: In merging word processing form letters and customer or vendor information to print needed business letters.

Skill: In retrieving information stored in an electronic data processing system to generate reports needed for effective management of the marketing business.

Skill: In starting up and communicating with the (micro)computer to utilize a variety of application software packages.

Skill: Ability to personalize written and verbal communications so that the customer or vendor is not distressed by electronic data processing equipment or its application in the business (avoid depersonalization that may result from references to "the computer did it").

Skill: Ability to scan information stored in electronic data processing equipment to locate and "flag" information that should be brought to the attention of management.

Attitude: Belief that all employees have a responsibility to keep informed of technical advances and new methods in electronic data processing that apply to marketing and distribution by reading trade journals and publications and through participation in professional organizations, conferences, or other professional development activities.

Skill: Ability to apply electronic data processing and related electronic communications networks to improve communications between various departments and divisions within a marketing business resulting in more efficient operations and mutual benefits to all.

Skill: Ability to exchange information between electronic devices to achieve a desired goal (make necessary cable connections, depress necessary keys, enter enabling commands, etc.).

Skill: In printing forms that are clear, accurate, and correctly spaced.

DISPLAY

Skill: In utilizing the store's display fixture data base to locate various display fixtures in the store, to determine if fixtures are available for the construction of new displays, and to update the data base on the (new) location of display fixtures and their condition.

Skill: In storing, searching, retrieving, and creating display layouts utilizing the computer assisted design capabilities of the (micro)computer to select the optimal type of arrangement for a given situation.

Skill: In printing out a list of all the fixtures, tools, and supplies necessary to construct a display that was designed and/or stored on the (micro)computer.

Skill: In accessing, searching, or adding to a list of seasonal or storewide promotional themes stored on (micro)computer storage media.

Skill: In designing, lettering and printing point-of-sale signs using computer assisted design and graphics capabilities of the (micro)computer.

Skill: In developing a scheduling plan of displays and display themes using the (micro)computer.

Skill: In simulating the effects of various display-lighting techniques on the (micro)computer in combination with display layouts to select the most effective lighting technique.

Skill: In data entry to input copy for point-of-sale signs using (micro)computers and related graphics software packages.

Skill: In using the (micro)computer to obtain current fashion and merchandising information necessary for effective and timely display.

Skill: In using the (micro)computer to monitor customer traffic and merchandise selection as an aid for future planning of store layout and merchandise displays.

Skill: In using an on-line inventory manangement system to monitor display merchandise so that it is returned to selling departments quickly following its removal from display.

Skill: In using the store's display fixture data base to monitor the quantity of each type of display fixture in the store; the condition of display fixtures for scheduling maintenance; and requests for display fixtures, supplies and equipment to plan for needed purchases.

Skill: In using the (micro)computer to analyze and correlate display requests from individual departments with the program of the advertising department.

HUMAN RELATIONS

Knowledge of or Understanding that: The variety of reactions that customers, suppliers, and employees may have to becoming familiar with the store's computerized operations.

Knowledge of or Understanding that: How to assist others in overcoming negative attitudes about the store's computerized operations.

Knowledge of or Understanding that: How to utilize the (micro)computer to personalize the store's correspondence and other interaction with customers and suppliers to improve the store's public relations.

Knowledge of or Understanding that: How to utilize data bases containing information about people to select accomplishments and important events in their lives for recognition, including personalized letters or personal contact by a store representative.

Skill: In monitoring selected employee behaviors (absenteeism, tardiness, employee turnover, etc.) using the (micro)computer to plan how to improve human relations practices, morale and productivity.

Skill: In using a computerized employee training data base (task analysis of each job) to develop and implement an individualized employee training plan for each employee based upon the employee's present competencies and those competencies required for success in their assigned job.

Skill: In using the (micro)computer and related software to schedule customers for services.

Skill: In demonstrating initiative and creativity in identifying new applications of (micro)computers, and in accessing, enhancing, and processing information for the business.

Skill: In identifying adjustments that may be made in (micro)computer applications to improve the attitudes of employees that may be interferring with their productivity.

Attitude: That an employee must be willing to accept, adjust to, and facilitate change resulting from the implementation of new technology in the business and the industry within which the business operates.

Knowledge of or Understanding that: How to use the (micro)computer in maintaining personnel records for good employee relations and increased morale.

Skill: Ability to deal with people both internally and externally in relation to information needed for the business' computerized operations.

Knowledge of or Understanding that: How to use the (micro)computer to monitor the integrity and honesty of suppliers and employees in relation to inventory of products and supplies.

MATHEMATICS

Skill: In maintaining markup and markdown records as a component of the store's on-line inventory management system.

Skill: In entering, reviewing, controlling, and projecting the firm's operating expenses using the (micro)computer and related accounting and statistical software.

Skill: In maintaining, reviewing, and projecting sales and gross margin using the (micro)computer and related accounting and statistical software.

Knowledge of or Understanding that: The relationship between the business' practice for physically inventorying merchandise and supplies and the procedures and information involved in the business' on-line inventory management system.

Skill: In using a (micro)computer to assemble the information and to print a profit and loss statement.

Skill: In using the (micro)computer to perform mathematical manipulations up to and including first degree algebraic expressions.

Skill: In entering corrections into the on-line inventory management system that resulted from cash register/point-of-sale terminal errors.

Skill: In maintaining accurate computerized records of cash received and bank deposits.

Skill: In using the (micro)computer to perform a variety of merchandising calculations including at least the following: employee discounts, quantity discounts, delivery charges, alteration charges, lay-away charges, markup and markdown percentages and amounts, break even points, stock-to-sales ratios, stock turn, optimal reorder points, trade discounts, and open-to-buy.

Knowledge of or Understanding that: How to keep stock control books and the on-line inventory management system updated so that both reflect the same information.

Skill: In using a point-of-sale cash register/terminal.

Skill: Ability to enter into the point-of-sale cash register/terminal information on merchandise being purchased that is multiple unit priced.

Skill: Ability to utilize the (micro)computer to perform mathematical operations (addition, subtraction, multiplication, division, exponentiation and roots) individually and in strings; and to use and translate fractions, decimals, and percentages.

Skill: Ability to use the (micro)computer to calculate and print interest, depreciation, tax, and annuity tables.

Skill: Ability to use the (micro)computer to print a cost analysis of each item including all operating expenses as well as the cost of the item itself.

MERCHANDISING

Knowledge of or Understanding that: How to utilize the on-line inventory management system to monitor prices for establishment and review of pricing policies.

Knowledge of or Understanding that: How to update the on-line inventory management system to reflect additions to stock, to record transfer of stock to branch stores, and to record return of merchandise to suppliers.

Knowledge of or Understanding that: How to update the on-line inventory management system to refelct differences in quantities noted during a physical inventory.

Knowledge of or Understanding that: How to update the on-line inventory management system to reflect merchandise and supplies on order and not yet received, how to update the system when orders are received and placed into stock, and how to update the system when supplies are requisitioned from stock.

Knowledge of or Understanding that: How to process special orders for merchandise in relation to the on-line inventory management system.

Knowledge of or Understanding that: How to use the (micro)computer in the process of reviewing competitive bids before placing orders.

Knowledge of or Understanding that: How to update the on-line inventory management system to reflect changes in prices, descriptors, availability, suppliers, purchasing terms, transportation, and etc.

Skill: In using the (micro)computer in the preparation of a model (or basic) stock plan.

Knowledge of or Understanding that: How to update the on-line inventory, management system to reflect customers' merchandise returns.

Knowledge of or Understanding that: How the on-line inventory management system is used to prepare and/or automatically place orders for merchandise.

Knowledge of or Understanding that: How to use the (micro)computer to determine (or modify) the quantity of merchandise to buy when reordering merchandise.

Skill: Ability to use the (micro)computer to keep records of merchandise sold by classification.

Skill: Ability to use the (micro)computer to analyze proposals to purchase merchandise, either authorizing, revising, or rejecting the proposal in light of sales forcasts, stock conditions, advertising and promotional plans, merchandise buying plans, or accounting and financial plans.

Knowledge of or Understanding that: How to utilize information from the on-line inventory management system to keep buyers informed of sales trends and merchandise at low quantity points.

Knowledge of or Understanding that: How to use an on-line inventory management system to maintain a balanced stock.

Knowledge of or Understanding that: How to distinguish between promotional merchandise and staple merchandise when reviewing information in the on-line inventory management system.

Knowledge of or Understanding that: How to utilize the (micro)computer to monitor merchandise orders received and manufacturer invoices to assure prompt payment is made in order to take advantage of discounts that may be offered.

Knowledge of or Understanding that: How to utilize the on-line inventory management system to monitor sales activity and merchandise quantities of the main store, or groups of stores (combinations of the main, branch and suburban stores).

Knowledge of or Understanding that: How to utilize the (micro)computer to prepare lists of merchandise to be used in shopping competitors.

Skill: In using the on-line inventory management system to identify "hot items" and in communicating this information to buyers, the advertising department, and the selling staff.

Skill: In using an on-line inventory management system to identify over-stocked or under-stocked items.

Knowledge of or Understanding that: How to store information in an on-line inventory management system so that information about items can be sorted, retrieved, or updated on the computer by using logical grouping or related item information.

Skill: In using the (micro)computer to set up and update merchandise buying plans for a specified time period.

GAO/8186r

Microcomputers offer vocational instructors an opportunity to renew the focus of classroom instruction on the development of knowledge, skills and attitudes that can (and should) be applied immediately on-the-job. The thrust of planning to integrate microcomputers into every program in vocational education must match this essential philosophy: train students to use (micro)computers the way they will be used in business and industry.

INTEGRATING MICROCOMPUTERS INTO MARKETING AND DISTRIBUTIVE EDUCATION

Written by David A. Howerton, Consultant; Business, Marketing and Management Occupations; Illinois State Board of Education/Department of Adult, Vocational and Technical Education

Competency based training is no newcomer to Marketing and Distributive Education. The addition of microcomputers to the instructional program lends itself to the same competency development process--job (task) analysis, competency identification, validation, and instructional materials development. Furthermore, it is possible to "short circuit" this process, temporarily, to speed our responsiveness to urgent requests for microcomputer skills for students who will be in upper grades this year.

To develop "good" instruction quickly, the focus of instruction about microcomputers should be placed immediately on the APPLICATION of microcomputers to solve business problems. A variety of modes of learning have been identified for microcomputer instruction, including computer assisted instruction (CAI), computer managed instruction, simulation, and application. Of these modes of learning, educators have tended to place emphasis on the potential for computer assisted instruction and computer managed instruction. These modes of learning could be used for delivering instruction in many classrooms, but neither directly prepares students with skills to use microcomputers. Vocational instruction must concentrate less on using the microcomputer to teach and more on how to use the microcomputer. Consequently, simulation and application are more "appropriate" to vocational education.

Nor is it true that all students should be trained to be programmers.

Few employees on-the-job other than computer programmers will be required to develop sophisticated computer programs from scratch by themselves. The skill that will be required of most employees will involve matching the capabilities of the (micro)computer and "canned" software packages to identified problems, or accessing information from data networks through a computer terminal. This is not to say that students should not have some programming knowledge and skill. It may be desirable or necessary to customize software to more closely match a particular business operation or procedure. Students are likely to develop introductory programming skill in computer literacy courses taught as part of their "general education." One additional programming course for business students (including both business and office, and marketing and distributive education) may be necessary to emphasize business programming languages and relate programming more directly to business applications.

While this discussion may tend to make microcomputer instruction sound very simple ("turn on the machine, stick in a program, and you're ready"), there are a number of higher level skills that must be developed. Prior to applying microcomputers to solving business problems, the problems must be identified and analyzed, the inputs and outputs must be defined, and a logical sequence of steps must be determined to move from the problem to its solution. In short, students must be trained to use the microcomputer as a tool, and they must be taught a problem solving process to use in doing this.

Part of the problem solving process that students must be taught involves instruction in the logical process that the computer uses to arive at an answer. It will be necessary to emphasize that humans are capable of making "mental leaps" by combining small steps while computers must have every small step spelled out. This is difficult to learn for some "bright" students who tend to think intuitively. On the other hand, students who may need the presentation of all the steps in the process to be able to understand how to solve a problem are likely to benefit. (Perhaps you remember a math class in which you were unable to understand how to solve a problem until the teacher went back and added a small step that they considered to be "obvious.")

Short circuiting the competency development process to determine the specific content to be taught is not difficult. There are actually at least two ways to go about it. The first way is to identify and purchase typical business application software packages and teach the students how to use them. This instruction should begin as soon as students develop basic keyboarding skills. Students in all of vocational education should be given an orientation to a variety of these application software packages through hands-on experiences, taught about the role of software documentation, and have an opportunity to view data processing in action in local business and industry. (See the suggested course description for "Computers in Vocational Education.") Experiences following this orientation level course should be planned to develop skill in utilizing microcomputers and application software. Typical types of software packages that would be useful for business and office, and marketing and distributive education would include data base management, text-editing/word processing, and accounting and statistical packages.

A second approach to short circuiting the competency development process builds upon this first approach in its use of business application software. This second approach involves reviewing the full range of competencies for marketing and distributive education and attempting to determine how computerized equipment might be involved in the performance of these competencies. After the competencies have been identified and rewritten to reflect the need for (micro)computer skills, it is necessary to match business application software to the (new) competencies. To facilitate the development of instruction utilizing this approach, one possible list of these (new) competencies is included with these materials.

In Conclusion

The integration of microcomputers into marketing and distributive education can be accomplished efficiently, in such a way that "good" instruction results because efforts are in tune with the needs of business and industry. The focus of these materials has been to encourage the use of the existing competency development process to decide specific content to be taught. Due to the need to respond immediately to provide microcomputer skills for students who are in upper grades, two suggestions are offered to temporarily "short circuit" the process to provide competencies that fit into the existing instructional delivery process. Not addressed here are the issues of assisting teachers to become computer literate, or obtaining the resources for microcomputer instruction. Finally, resources are included with these materials including one possible list of microcomputer competencies for marketing and distributive education, and an outline suggesting "What Vocational Instructors Need to Know to Successfully Integrate Microcomputers Into Their Programs."

WHAT VOCATIONAL INSTRUCTORS NEED TO KNOW TO SUCCESSFULLY INTEGRATE MICROCOMPUTERS INTO THEIR PROGRAMS

I. Microcomputer Terminology

- Types of Computers
  - Main Frame
  - Minicomputer
  - Microcomputer

- Hardware
  - Microprocessor
  - Keyboard
  - Cathode Ray Tube (CRT)
  - Numeric Keypad
  - Central Processing Unit (CPU)
  - Memory
    - RAM
    - ROM
    - BIT
    - BYTE
    - K
    - Megabyte

- Peripherals
  - Disk Drives
  - Hard Disk
  - Floppy Disk(ette)
    - Single Density
    - Double Density
    - Single Sided
    - Double Sided
  - Modem
  - Printer
    - Dot Matrix
    - Daisy Wheel
    - Hard Copy
    - Thermal Printer
    - Plotter
    - Dot Addressable Graphics
    - Descending Characters
    - Plotter
  - Cassette Tape Recorder
  - Network Controler
  - Digitizer

- Software
  - Computer Assisted Instruction (CAI)
  - Computer Managed Instruction
  - Simulation
  - Application Software
  - Data Base Management
  - Word Processing/Text Editing
  - Accounting and Statistical
  - Documentation

- Programming Languages
  - BASIC
  - Disk BASIC
  - COBOL
  - FORTRAN
  - LOGO
  - PILOT
  - Machine Language
  - Assembly Language

- Miscellaneous Terms
  - Compiler
  - Disk Operating System
  - Interface
    - RS232
  - Spooling
  - Videotex
  - High End System
  - Information Processing
  - Analog
  - Digital
  - Authoring System
  - Buffer
  - RF Modulator
  - User Groups
  - Pixels

II. What You Need to Know Before You Select a Microcomputer for Vocational Education

1. What brands of microcomputers are being purchased by other schools?

2. Should students be taught on only one brand of microcomputer or should they be exposed to a variety of brands?

3. What type of microprocessor is currently being used in the microcomputers used in vocational classrooms? What benefits are offered by new 16 BIT microprocessors?

4. How much memory do we need for our microcomputers?

5. How many characters in length should be displayed on each line on the video display (also refered to as the CRT or TV screen)?

6. What features should we look for when evaluating keyboards?

7. What benefits are offered by numeric keypads?

8. How many disk drives do we need for each student computer?

9. Is a standard disk operating system available?

10. What characteristics should be considered when looking for a printer?

11. What are the costs and the benefits of networking microcomputers? What are the disadvantages?

12. What criteria should we use to select a CRT (video display monitor)? Is color an important consideration? Is green and white superior to black and white?

13. Is local repair service available?

14. Does the equipment supplier provide support services after the equipment is delivered to the school? What types of services are offered by suppliers?

15. What can microcomputers do in the way of graphics?

16. Is there a good supply of software for the brand of microcomputer we want to buy?

17. Is it possible to upgrade the equipment that we buy now without having to replace it

18. How do you use a microcomputer as a terminal?

19. What computer languages do we need to teach our students?

20. What is the optimal number of students per computer in vocational classes?

21. What discounts are available to schools for the purchase of microcomputers, peripherals, software/courseware, and supplies?

22. Is sound available for the microcomputers? Is it important for instruction?

23. Do we really need a telephone modem?

24. What are the usual features of service contracts and what costs can we expect?

25. What suggestions can you give us on the types and quantities of supplies to purchase for our microcomputers?

26. What kinds of questions should we ask our Local Advisory Council for Vocational Education about microcomputers?

27. How do we tell vendors exactly what we want in the bid process?

III. A Checklist of Items to Consider in Preparing Teachers to Teach:
Using Microcomputers to Teach and Teaching about Microcomputers

_____Teacher Certification Requirements
_____Rules and Regulations affecting Vocational Education
_____Has mastered competencies necessary to be computer literate
_____Knowledge of criteria to use in evaluating software
_____Knowledge of procedures to follow to translate a problem into software
_____Knowledge of authoring systems or authoring languages to use in writing software
_____Knowledge of difficulties involved in translating software for one brand of microcomputer so that it can be used on another brand
_____Skilled in making backup copies of source data, software;storage procedures
_____Knowledge of security procedures to protect confidential information
_____Knowledge of workshops available on microcomputers, other inservice opportunities
_____Knowledge of consultant assistance available from the state board of education
_____Skilled in using computer wise students
_____Knowledge of restrictions on duplication of software based upon copyrights
_____Knowledge of trends in software protection to reduce software "piracy"

IV. A Checklist of Items to Consider in Planning Instruction:
Using Microcomputers to Teach and Teaching about Microcomputers

_____Microcomputer instruction is sequenced in and across vocational programs
_____Microcomputer instruction builds upon computer literacy competencies taught in general education classes
_____Students have keyboarding skills prior to entering courses that primarily involve entering information into a microcomputer using the keyboard
_____NO PREREQUISITES are listed from math or science!!!
_____Microcomputer instruction is (to be) integrated into existing courses?
_____Separate courses about the microcomputer in vocational education are to be establishe
_____Instruction provides skills in computer languages required for employment (BASIC is not enough)
_____Courses are articulated across all grade levels
_____Efforts have been made to articulate courses/programs with community colleges
_____Microcomputers are used to assist the delivery of competency based instruction
_____Microcomputers and software/courseware are used to simulate real world experiences that vocational students must master
_____Computer assisted and computer managed instruction does more than provide rote learning, more than covert textbook pages to screens of text.
_____Students will learn to use application software packages for situations that match those found in business and industry
_____Not all students must learn to program; Instruction develops logical thinking and knowledge of how to organize a problem so that a computer program could be written to solve the problem
_____Instruction develops positive attitudes toward ethics in computer use and in gaining access to information

V. Where do You Put the Microcomputers that You Buy?

Should you integrate a few microcomputers into many classrooms?

What are the advantages of putting together a classroom of microcomputers?

What are some criteria that may be used to decide where to place the microcomputers?

A. Security
B. Static electricity
C. Glare from windows or lights
D. Power distribution in the room(s); existence of dedicated electric circuits
E. Dust; chalk dust, too! Chalkless chalkboards
F. Temperature in the rooms; temperature during vacations
G. Location of water pipes; potential for flooding
H. Accessibility to students; handicapped students; accessibility during early morning and after school hours; accessiblity during lunch breaks; accessibility to teachers
I. Ease in monitoring/controling student use
J. Which teachers are computer literate? Which teachers have the greatest need to become computer literate?

Marketing Competencies Involving the Use of (Micro)computers Peripherals and Software

ADVERTISING

Skill: In developing advertising layout and illustrations using stored information and the graphics capability of the (micro)computer and printer.

Knowledge of or Understanding that: How to advertise using electronic mail or voice mail and message systems.

Skill: In using (micro)computers to prepare an advertising budget and schedule of advertising.

Skill: In using on-line inventory management systems to verify the availability of merchandise in the quantity necessary to back-up an advertisement.

Skill: In using the (micro)computer for archival storage of advertising.

Skill: In using (micro)computer software to evaluate the effectiveness of advertising campaigns.

Skill: In maintaining customer/prospect or vender lists on (micro)computers.

Skill: In accessing data bases to identify new prospects.

Skill: In using (micro)computer models of populations to select market segmentation strategy.

Skill: Using data bases to retrieve information on special events in the life of customers to which personalized advertising can be directed. (e.g.: birthdays, anniversaries, weddings, funerals, graduations, etc.).

Skill: In using (micro)computers to keep informed about sales promotion activities in the store.

Skill: In using on-line inventory management systems to locate advertised merchandise in the store and to check on its availability.

Skill: In using (micro)computer printouts of advertised merchandise to spotcheck displays for refilling, rearrangement, or notifying sales force of dwindling supply.

Skill: In using an on-line inventory management system to check pricing and availability of merchandise in the store against competitors' advertised prices.

COMMUNICATIONS

Knowledge of or Understanding that: Existing forms and formats used for electronic data processing/information processing.

Knowledge of or Understanding that: Basic word processing concepts applied to business letter writing.

Knowledge of or Understanding that: Business communication style for electronic mail.

Knowledge of or Understanding that: Commercial communications networks used for electronic communications.

Skill: In using telephone modems to communicate from (micro)computer to (micro)computer.

Skill: In using data entry forms designed to list all information necessary for a customer data base to interview customers (tactfully).

Skill: Ability to explain the store's electronic data processing system/operations in non-technical language to co-workers, customers, and vendors.

Skill: In using the on-line inventory management system to spot trends in sales and in communicating this information to the selling staff.

Skill: In retrieving information stored in electronic data processing equipment to use in communications with customers or vendors.

Skill: In using the telephone as a medium for electronic communications (not including voice communications).

Skill: In applying electronic data processing concepts to marketing practices and developing a vocabulary descriptive of current practices in electronic data processing.

Skill: In customizing application software to the specific needs of the business using explanatory handbooks and software documentation.

Skill: In data entry for electronic equipment so that information to be processed is accurate.

Skill: In selecting and making any necessary modifications in form letters stored in word processing to communicate a message to a customer.

Skill: In writing (new) form letters to be placed into word processing for entry, storage, retrieval, updating, and reprinting.

Skill: In identifying out-of-date forms and formats to be purged from word processing.

Skill: In entering customer names, addresses, and other needed information into the (micro)computer for storage or to be able to retrieve information from the customer's or vendor's file.

Skill: In utilizing software dictionaries to check the accuracy of spelling in documents.

Skill: In merging word processing form letters and customer or vendor information to print needed business letters.

Skill: In retrieving information stored in an electronic data processing system to generate reports needed for effective management of the marketing business.

Skill: In starting up and communicating with the (micro)computer to utilize a variety of application software packages.

Skill: Ability to personalize written and verbal communications so that the customer or vendor is not distressed by electronic data processing equipment or its application in the business (avoid depersonalization that may result from references to "the computer did it").

Skill: Ability to scan information stored in electronic data processing equipment to locate and "flag" information that should be brought to the attention of management.

Attitude: Belief that all employees have a responsibility to keep informed of technical advances and new methods in electronic data processing that apply to marketing and distribution by reading trade journals and publications and through participation in professional organizations, conferences, or other professional development activities.

Skill: Ability to apply electronic data processing and related electronic communications networks to improve communications between various departments and divisions within a marketing business resulting in more efficient operations and mutual benefits to all.

Skill: Ability to exchange information between electronic devices to achieve a desired goal (make necessary cable connections, depress necessary keys, enter enabling commands, etc.).

Skill: In printing forms that are clear, accurate, and correctly spaced.

DISPLAY

Skill: In utilizing the store's display fixture data base to locate various display fixtures in the store, to determine if fixtures are available for the construction of new displays, and to update the data base on the (new) location of display fixtures and their condition.

Skill: In storing, searching, retrieving, and creating display layouts utilizing the computer assisted design capabilities of the (micro)computer to select the optimal type of arrangement for a given situation.

Skill: In printing out a list of all the fixtures, tools, and supplies necessary to construct a display that was designed and/or stored on the (micro)computer.

Skill: In accessing, searching, or adding to a list of seasonal or storewide promotional themes stored on (micro)computer storage media.

Skill: In designing, lettering and printing point-of-sale signs using computer assisted design and graphics capabilities of the (micro)computer.

Skill: In developing a scheduling plan of displays and display themes using the (micro)computer.

Skill: In simulating the effects of various display-lighting techniques on the (micro)computer in combination with display layouts to select the most effective lighting technique.

Skill: In data entry to input copy for point-of-sale signs using (micro)computers and related graphics software packages.

Skill: In using the (micro)computer to obtain current fashion and merchandising information necessary for effective and timely display.

Skill: In using the (micro)computer to monitor customer traffic and merchandise selection as an aid for future planning of store layout and merchandise displays.

Skill: In using an on-line inventory manangement system to monitor display merchandise so that it is returned to selling departments quickly following its removal from display.

Skill: In using the store's display fixture data base to monitor the quantity of each type of display fixture in the store; the condition of display fixtures for scheduling maintenance; and requests for display fixtures, supplies and equipment to plan for needed purchases.

Skill: In using the (micro)computer to analyze and correlate display requests from individual departments with the program of the advertising department.

HUMAN RELATIONS

Knowledge of or Understanding that: The variety of reactions that customers, suppliers, and employees may have to becoming familiar with the store's computerized operations.

Knowledge of or Understanding that: How to assist others in overcoming negative attitudes about the store's computerized operations.

Knowledge of or Understanding that: How to utilize the (micro)computer to personalize the store's correspondence and other interaction with customers and suppliers to improve the store's public relations.

Knowledge of or Understanding that: How to utilize data bases containing information about people to select accomplishments and important events in their lives for recognition, including personalized letters or personal contact by a store representative.

Skill: In monitoring selected employee behaviors (absenteeism, tardiness, employee turnover, etc.) using the (micro)computer to plan how to improve human relations practices, morale and productivity.

Skill: In using a computerized employee training data base (task analysis of each job) to develop and implement an individualized employee training plan for each employee based upon the employee's present competencies and those competencies required for success in their assigned job.

Skill: In using the (micro)computer and related software to schedule customers for services.

Skill: In demonstrating initiative and creativity in identifying new applications of (micro)computers, and in accessing, enhancing, and processing information for the business.

Skill: In identifying adjustments that may be made in (micro)computer applications to improve the attitudes of employees that may be interferring with their productivity.

Attitude: That an employee must be willing to accept, adjust to, and facilitate change resulting from the implementation of new technology in the business and the industry within which the business operates.

Knowledge of or Understanding that: How to use the (micro)computer in maintaining personnel records for good employee relations and increased morale.

Skill: Ability to deal with people both internally and externally in relation to information needed for the business' computerized operations.

Knowledge of or Understanding that: How to use the (micro)computer to monitor the integrity and honesty of suppliers and employees in relation to inventory of products and supplies.

MATHEMATICS

Skill: In maintaining markup and markdown records as a component of the store's on-line inventory management system.

Skill: In entering, reviewing, controlling, and projecting the firm's operating expenses using the (micro)computer and related accounting and statistical software.

Skill: In maintaining, reviewing, and projecting sales and gross margin using the (micro)computer and related accounting and statistical software.

Knowledge of or Understanding that: The relationship between the business' practice for physically inventorying merchandise and supplies and the procedures and information involved in the business' on-line inventory management system.

Skill: In using a (micro)computer to assemble the information and to print a profit and loss statement.

Skill: In using the (micro)computer to perform mathematical manipulations up to and including first degree algebraic expressions.

Skill: In entering corrections into the on-line inventory management system that resulted from cash register/point-of-sale terminal errors.

Skill: In maintaining accurate computerized records of cash received and bank deposits.

Skill: In using the (micro)computer to perform a variety of merchandising calculations including at least the following: employee discounts, quantity discounts, delivery charges, alteration charges, lay-away charges, markup and markdown percentages and amounts, break even points, stock-to-sales ratios, stock turn, optimal reorder points, trade discounts, and open-to-buy.

Knowledge of or Understanding that: How to keep stock control books and the on-line inventory management system updated so that both reflect the same information.

Skill: In using a point-of-sale cash register/terminal.

Skill: Ability to enter into the point-of-sale cash register/terminal information on merchandise being purchased that is multiple unit priced.

Skill: Ability to utilize the (micro)computer to perform mathematical operations (addition, subtraction, multiplication, division, exponentiation and roots) individually and in strings; and to use and translate fractions, decimals, and percentages.

Skill: Ability to use the (micro)computer to calculate and print interest, depreciation, tax, and annuity tables.

Skill: Ability to use the (micro)computer to print a cost analysis of each item including all operating expenses as well as the cost of the item itself.

MERCHANDISING

Knowledge of or Understanding that: How to utilize the on-line inventory management system to monitor prices for establishment and review of pricing policies.

Knowledge of or Understanding that: How to update the on-line inventory management system to reflect additions to stock, to record transfer of stock to branch stores, and to record return of merchandise to suppliers.

Knowledge of or Understanding that: How to update the on-line inventory management system to reflect differences in quantities noted during a physical inventory.

Knowledge of or Understanding that: How to update the on-line inventory management system to reflect merchandise and supplies on order and not yet received, how to update the system when orders are received and placed into stock, and how to update the system when supplies are requisitioned from stock.

Knowledge of or Understanding that: How to process special orders for merchandise in relation to the on-line inventory management system.

Knowledge of or Understanding that: How to use the (micro)computer in the process of reviewing competitive bids before placing orders.

Knowledge of or Understanding that: How to update the on-line inventory management system to reflect changes in prices, descriptors, availability, suppliers, purchasing terms, transportation, and etc.

Skill: In using the (micro)computer in the preparation of a model (or basic) stock plan.

Knowledge of or Understanding that: How to update the on-line inventory, management system to reflect customers' merchandise returns.

Knowledge of or Understanding that: How the on-line inventory management system is used to prepare and/or automatically place orders for merchandise.

Knowledge of or Understanding that: How to use the (micro)computer to determine (or modify) the quantity of merchandise to buy when reordering merchandise.

Skill: Ability to use the (micro)computer to keep records of merchandise sold by classification.

Skill: Ability to use the (micro)computer to analyze proposals to purchase merchandise, either authorizing, revising, or rejecting the proposal in light of sales forcasts, stock conditions, advertising and promotional plans, merchandise buying plans, or accounting and financial plans.

Knowledge of or Understanding that: How to utilize information from the on-line inventory management system to keep buyers informed of sales trends and merchandise at low quantity points.

Knowledge of or Understanding that: How to use an on-line inventory management system to maintain a balanced stock.

Knowledge of or Understanding that: How to distinguish between promotional merchandise and staple merchandise when reviewing information in the on-line inventory management system.

Knowledge of or Understanding that: How to utilize the (micro)computer to monitor merchandise orders received and manufacturer invoices to assure prompt payment is made in order to take advantage of discounts that may be offered.

Knowledge of or Understanding that: How to utilize the on-line inventory management system to monitor sales activity and merchandise quantities of the main store, or groups of stores (combinations of the main, branch and suburban stores).

Knowledge of or Understanding that: How to utilize the (micro)computer to prepare lists of merchandise to be used in shopping competitors.

Skill: In using the on-line inventory management system to identify "hot items" and in communicating this information to buyers, the advertising department, and the selling staff.

Skill: In using an on-line inventory management system to identify over-stocked or under-stocked items.

Knowledge of or Understanding that: How to store information in an on-line inventory management system so that information about items can be sorted, retrieved, or updated on the computer by using logical grouping or related item information.

Skill: In using the (micro)computer to set up and update merchandise buying plans for a specified time period.

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OPERATIONS

Skill: In using the (micro)computer in analyzing and aging customer accounts for the store's use and use by the credit bureau.

Skill: In using the (micro)computer to verify the customer's credit (determine if the customer has a credit account, the amount of the line of credit, the unpaid balance of the account, the amount of unused credit, the date of the last payment, and the date that the next payment is due).

Skill: In using the (micro)computer in the review of credit accounts to identify slow payers or potentially uncollectable accounts.

Knowledge of or Understanding that: The maintenance plan and procedures to be followed for the store's (micro)computer system.

Knowledge of or Understanding that: The expenses involved in operating and maintaining the store's (micro)computer system.

Skill: In utilizing the store's computerized system for authorizing customer checks.

Skill: In assisting customers in operating electronic funds transfer system equipment in the store (equipment that instantly transfers money from the customer's bank account to the store's bank account).

Skill: In using scanning devices that "read" universal product codes (UPC) and/or specially printed characters (optical character recognition--OCR).

Knowledge of or Understanding that: How to utilize the (micro)computer to accumulate the daily sales information from the departments, to prepare the store's cash report; and to record federal, state and local sales taxes.

Knowledge of or Understanding that: How to utilize the office computer to take departmental sales readings periodically throughout the selling day.

Skill: In using the (micro)computer to print daily sales reports by department for the total business.

Knowledge of or Understanding that: How to utilize the on-line inventory management system to determine or update the quantity that should be kept on-hand of each item to assure an adequate supply.

Skill: In matching merchandise received against order information stored in the business' computer system.

Skill: In utilizing the store's on-line inventory management system to determine the correct price for an unmarked item.

Skill: In utilizing the store's on-line inventory management system to find the location of merchandise and reserves within the business (location on the sales floor, or location in the warehouse or stockroom).

Knowledge of or Understanding that: How to utilize the (micro)computer to identify expense categories for which additional cost control efforts should be implemented.

Knowledge of or Understanding that: The types of (micro)computer records that may be kept to control the store's operation.

Knowledge of or Understanding that: How to use the (micro)computer to assign a storage location in the stock area or on the sales floor for arriving merchandise, fixtures, or supplies.

Knowledge of or Understanding that: How to utilize the (micro)computer to calculate and maintain profit and loss records on various items that are sold.

Skill: In using credit department equipment including computerized data entry and retrieval systems, micrographic, and charge card/bank card equipment.

Skill: In using the (micro)computer to sort customer billings or other mailings according to address information as required to minimize postal costs.

Skill: In planning and organizing work to be processed by the store's (micro)computer.

Knowledge of or Understanding that: How analog-to-digital periphearls may be used to monitor various operations and locations within the store for property protection and store security.

Knowledge of or Understanding that: How to use the (micro)computer in the process of performing a customer/patron analysis for planning improvements in store operations.

Skill: In using the (micro)computer in analyzing operating and sales information to schedule sales personnel for adequate coverage.

Skill: In utilizing the (micro)computer to prepare required shipping records as they relate to billing, inventory control, and other related functions.

Skill: Ability to use the (micro)computer to prepare various documents such as bills of lading, freight bills, load manifests, delivery receipts, etc.

Skill: In using the (micro)computer and application software to plan routing and calculate the costs for the transportation of goods, minimizing freight charges and facilitating smooth transfer of shipments to and from carriers.

Skill: In keeping computerized receiving records up-to-date as required for effective inventory management.

MANAGEMENT

Knowledge of or Understanding that: General principles and practices of data management.

Skill: Ability to utilize computerized accounting, financial, and records management system.

Skill: In selecting (micro)computer software and identifying modifications that may be necessary to meet the requirements of the business and/or to provide information required by external agencies to whom the business must report.

Skill: In using the (micro)computer to improve planning, organization, time management, problem solving and follow-up functions.

Attitude: Consistently acts to assure that information in the (micro)-computer data storage media is reviewed and updated regularly to keep it current, accurate, and useful.

Attitude: Consistently prepares backup copies of all (micro)computer data and software, and places originals in secured storage.

Skill: In monitoring and controlling freshness, damage, and spoilage of products by using an on-line inventory management system.

Knowledge of or Understanding that: How to use the (micro)computer in employee training.

Skill: In using the (micro)computer to plan work-force budgets and to schedule employees.

Knowledge of or Understanding that: How to maintain employee records on the (micro)computer.

Skill: In using the (micro)computer to project, develop, and monitor a six-month or yearly budget for a sales-supporting department.

Knowledge of or Understanding that: How to assure the security of confidential information stored in the (micro)computer or on data storage media.

Knowledge of or Understanding that: The types of activities performed in the business that can be computerized in order to respond more quickly to customers and suppliers.

Knowledge of or Understanding that: How to use the (micro)computer to identify and evaluate potential sites for opening new (store) units.

Skill: In using the on-line inventory management system to monitor merchandise supplies and reserve stock so as to minimize merchandise inventory costs while providing adequate safety stock for the planned merchandise mix.

Knowledge of or Understanding that: How to use the (micro)computer to compute and tabulate percentages and averages representing operating performance and comparing these to historical data and/or industry standards for use in evaluating operating trends.

Skill: In using the (micro)computer to interview potential employees, maintaining a consistent format in the interview, gathering complete information that can easily be accessed and reviewed; merging candidate information into the employee file for those candidates who are hired; and maintaining information on candidates for positions that may open later.

Knowledge of or Understanding that: Types of computerized records that may be used to analyze and supervise the work of employees at different levels.

Knowledge of or Understanding that: How to use the on-line inventory management system and display layout software to manage the merchandise mix, determine the placement of items on the sales floor and in reserve stock areas; and set the size of merchandise displays in relation to floor space expense, potential sales and profit contribution.

Skill: Ability to use the (micro)computer to simulate the impact of anticipated changes (in customer shopping habits, local market conditions or other business risks) on merchandise mix, buying, operations, personnel, scheduling, etc.

Skill: In using the (micro)computer to maintain and manage a consistent, challenging schedule of job classifications, wages, salaries, commissions, and quotas for personnel.

Knowledge of or Understanding that: How to use a word processing system to maintain and update copies of the company regulations, policies, procedures, employee job descriptions, and employee training materials.

Knowledge of or Understanding that: How to use a (micro)computer to maintain a current listing of replacement parts for products sold and product/service warranty information.

Knowledge of or Understanding that: How to use information from the on-line inventory management system and physical inventories to keep employees informed of items that have significant risk of shrinkage.

Skill: In using (micro)computer models to simulate the following situations: (1) Changes in demand that should result from changes in prices (given an approximate supply and demand curve and alternative pricing decisions), (2) Impact on sales from competition in the market place (given changes in number or strategy of competitors), (3) Impact on merchandising mix of new products entering the market, (4) Impact on sales of a given product as the product progresses through its product life cycle, (5) Impact on labor costs of alternative decisions about scheduling employees, (6) Impact on lost profits and cost of goods due to alternative decisions about procedures for reducing shoplifting, (7) Impact on effectiveness of the on-line inventory control system to minimize costs of inventory due to alternative decisions about procedures for reducing the number of errors made on point-of-sale terminals (cash registers), (8) Planning the number of checkouts to have open to meet different levels of customer demands.

Skill: In using the following capabilities of the (micro)computer in the business: (1) information storage and retrieval (e.g.: record-keeping, data-bases, (2) simulation and modeling, (3) process/machine control (e.g.:

robotics, analog device monitoring), (4) computation (e.g.: numerical/statistical analysis of data), (5) data processing, (6) word processing, (7) graphics and computer assisted design, (8) speech synthesis, (9) artificial intelligence.

Knowledge of or Understanding that: Innovations in computer hardware and software continually expand the potential utility of the computer.

Skill: In assessing the feasibility, potential benefits, and hazards of a computer-supported application.

Knowledge of or Understanding that: General criteria for computer usage for a particular task (e.g.: purpose, time and resource constraints, ethical or moral considerations, relevance).

PRODUCT/SERVICE TECHNOLOGY

Skill: In accessing product or service information stored in the on-line inventory management system or other computerized information system for use in assisting customers.

Skill: In maintaining and accessing information in the computerized information system that crossreferences products to main features and benefits of the product, competing products, substitute items, and other related items or accessories.

Skill: In using the (micro)computer to project the impact of changing the size of food portions on restaurant profits.

Skill: In using word processing to plan, maintain and update restaurant menus.

Skill: In using a computerized restaurant management system when seating guests, sending orders and special instructions to the kitchen, providing service at various points throughout the meal, preparing the guest check, and recording payment (including the approval of credit purchases).

Skill: In accessing information stored in the computerized information system to determine the best way to service a product as well as the availability and price of replacement parts and accessories.

SELLING

Knowledge of or Understanding that: The procedures to use when preparing a sales check using a point-of-sale terminal.

Knowledge of or Understanding that: How to enter, retrieve, and fill (or cancel) mail or telephone orders for merchandise in the on-line inventory management system.

Skill: In utilizing a customer data base to determine the names of customers for use while serving them.

Attitude: Consistently accesses the computerized information management system to receive instructions on activities to be performed during slow selling periods.

Skill: In identifying merchandise that is out-of-stock or in short supply and "flagging" such items in the on-line inventory management system.

Skill: In entering markup or markdown information into the on-line inventory management system.

Skill: In obtaining, evaluating and utilizing computerized lists of people to locate and qualify prospective buyers.

Skill: Maintain a computerized "listing file" in the real estate office with listings indexed, crossreferenced, and up-to-date.

Skill: In utilizing word processing to maintain form content for leases, real estate sales contracts and other contract documents.

Skill: In developing, maintaining, and updating a data base of information to use in providing customers with product information including a variety of product uses or applications.

Knowledge of or Understanding that: Ways to use the (micro)computer to increase the efficiency of selling efforts and in that way reducing the amount of nonproductive time when providing selling aide.

ECONOMICS/MARKETING

Skill: In using the (micro)computer to trace the location of ordered items through check points in the channel of distribution.

Skill: In using the (micro)computer in marketing research to analyze and summarize customer demographics and related needs and wants.

Skill: In using the (micro)computer to calculate and prepare payout tables for credit transactions.

Skill: In using the on-line inventory management system to modify the merchandise mix in keeping with seasonal business cycles and general patterns.

Knowledge of or Understanding that: How to apply (micro)computers and related application software to carry out management functions.

Skill: In the use of (micro)computer models of the business for analyzing the potential impact of economic trends.

Skill: In the use of (micro)computer models of the business for determining the impact of alternative decisions that could be made in negotiating with employee representatives/labor unions.

Skill: In the development and maintainence of a mailing list of all the potential customers of a good or service in the defined market area.

Skill: In using the (micro)computer to compute answers for real estate finance questions.

Skill: In using the (micro)computer and demographic models of a defined market area to determine if sufficient potential exists to justify addition of a product to the product mix.

Skill: In using the (micro)computer and demographic models of a defined market area to determine if sufficient potential exists to justify expanding floor space or opening a new store.

INFORMATION PROCESSING

Knowledge of or Understanding that: Software refers to computer programs and includes operating systems, compilers, and user (application) programs.

Knowledge of or Understanding that: Recognize that a computer needs instructions to operate.

Knowledge of or Understanding that: A computer gets instructions from a program written in a programming language by a person.

Knowledge of or Understanding that: Recognize computer programs are sets of sequential instructions which perform many tasks such as printing, sorting, and calculating.

Knowledge of or Understanding that: The basic elements of an information processing system are input, processing, and output, in that order.

Knowledge of or Understanding that: Information is data which has been given meaning.

Knowledge of or Understanding that: Data must be organized if it is to be useful.

Knowledge of or Understanding that: Computers process data by searching, sorting, deleting, updating, summarizing, and moving.

Knowledge of or Understanding that: Computer hardware refers to the physical components of computer systems.

Knowledge of or Understanding that: Chips are small pieces of silicon that contain electronic logic networks called circuits, and that a computer can be made up of chips mounted on boards.

Knowledge of or Understanding that: CPU stands for Central Processing Unit which is the part of the computer which carries out the essential and controlling tasks.

Knowledge of or Understanding that: The arithmetic, control, and memory units of a computer are generally regarded as comprising the CPU.

Knowledge of or Understanding that: The term "mainframe" refers to the CPU and its enclosure or to large computers.

Knowledge of or Understanding that: A microprocessor is a single chip containing all the electronic logic of a CPU.

Knowledge of or Understanding that: A microcomputer is a very small computer that uses a microprocessor for its Central Processing Unit.

Knowledge of or Understanding that: Minicomputers are a range of computers larger than microcomputers and smaller than what is usually called "mainframes."

Knowledge of or Understanding that: Identify the meaning of acronyms including ROM, RAM, PROM, EPROM, which identify different types of memory.

Knowledge of or Understanding that: Keyboards, punchcards, and magnetic tape serves as input media/devices.

Knowledge of or Understanding that: Video display screens, printers, punchcards, and magnetic tapes serve as output media/devices.

Knowledge of or Understanding that: The function of some basic communications technology, e.g.: networks, distributed networks, modem or acoustic-coupler.

Knowledge of or Understanding that: The distinctions among the following terms: bit, byte, register, and word.

Knowledge of or Understanding that: Both the loose and the precise definition of "K."

Knowledge of or Understanding that: How to distinguish and be able to identify special purpose from general purpose computers.

Knowledge of or Understanding that: How to distinguish between analog and digital computing operations.

Knowledge of or Understanding that: Identification codes and passwords are a primary means for restricting use of computer systems, of computer programs, and of data files.

Knowledge of or Understanding that: Procedures for detecting computer-based crimes are limited.

Knowledge of or Understanding that: Some advantages or disadvantages of a data base containing personal information on a large number of people; the list might include value for research and potential for privacy invasion.

Knowledge of or Understanding that: Recognize regulatory procedures affecting data processing such as priviledge to review one's own file and restrictions on use of universal personal identifiers, which help to insure the integrity of personal data files.

Knowledge of or Understanding that: "Privacy problems" are characteristic of large information files whether or not they are computerized.

Attitude: Alledged "computer mistakes" are usually mistakes made by people.

Skill: Ability to plan a strategy for tracing and correcting a (micro) computer-related error such as a billing error.

Skill: In identifying and evaluating the positive and negative consequences of (micro)computer use in specific situations.

Skill: In reading computer printouts.

Knowledge of or Understanding that: Computers are used to commit a variety of serious crimes, especially stealing money and stealing information.

Knowledge of or Understanding that: Features and capabilities of personal (micro)computer systems as compared to features and capabilities of large data processing systems.

GAO/8357r

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DATAPRO RESEARCH CORPORATION
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1805 Underwood Boulevard
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Building 223
3M Center
St. Paul, MN 55101

DATA TRANSFORMS
616 Washington Street
Denver, CO 80203

DATA-TYPE, INC.
2615 Miller Avenue
Mt. View, CA 94040

DENNISON KYBE Corporation
P.O. Box 36701
Strongsville, OH 44136

Materials: Flexible Disks, Data Cassettes, Magnetic Cards

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Tucker, GA 30084

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1427 Monroe Avenue
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Material: Software

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999 Plaza Drive, Suite 400
Schaumburg, IL 60195

Materia: Software

EDUCATIONAL AUDIO VISUAL, INC.
Pleasantville,
NY 10570

Material: Teaching Materials for Microcomputers

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EDUCATIONAL COMPUTER MAGAZINE
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Cupertino, CA 95015

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EICONICS, INC.
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ELECTRONIC COURSEWARE SYSTEMS, INC.
P.O. Box 2374
Station A
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61 First Street
Derby, Connecticut 06418

Material: DC-10 Manual

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Material: Evaluator's Guide for Microcomputer-Based Instructional Packages

EVANS NEWTON INCORPORATED
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Material: Software library microcomputer programs for educators

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Waltham, MA 02154

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San Diego, CA 92127

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University of Oregon
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THE S. KLEIN NEWSLETTER ON COMPUTER GRAPHICS
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Subscription Dept. - P.O. Box 89
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LINK SYSTEMS
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MACROTRONICS, INC.
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Machine: Screen Printer Interface for Atari

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Arlington, MA 02174

Material: Micro Software

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857 West State Street
Hartford, WI 53027

Material: Microfilm Equipment

MICRO INK, INC.
P.O. Box 6502
Chelmsford, MA 01824

Material: Software

MICRO LAB
2310 Skokie Valley Road
Highland Park, IL 60035

Material: Software

MICRO-LABS, INC.
902 Pinecrest
Richardson, TX 75080

Material: Software

MICRO MANAGEMENT SYSTEMS, INC.
115-C Second Avenue, S.W.
Cairo, GA 31728

MICROMATICS, INC.
181 North 200 West, Suite 5
Bountiful, UT 84010

MICROPRO
International Corporation
1299 Fourth Street
San Rafael, CA 94901

MICRO SCHOOL PROGRAMS
Bertamax, Inc.
101 Nickerson - Suite 202
Seattle, WA 98109

MICRO-SYSTEMS SOFTWARE, INC.
4301-18 Oak Circle
Boca Raton, FL 33431

MILADY PUBLISHING CORPORATION
3839 White Plains Road
Bronx, NY 10467

OMBUDSMAN EDUCATIONAL SERVICES, LTD.
1585 N. Milwaukee Avenue, Suite 9
Libertyville, IL 60048

ORTHOCODE CORPORATION
P.O. Box 6191
Albany, CA 94706

Material: Utility Software Program

SCHOOL MICROWARE
Dresden Associates
P.O. Box 246
Dresden, MA 04342

SCIENCE RESEARCH ASSOCIATES, INC
Matehmatics B
155 North Wacker Drive
Chicago, IL 60606

SCIENCE RESEARCH ASSOCIATES, INC.
College Division
P.O. Box 10021
Palo Alto, CA 94303

SCIENCE RESEARCH ASSOCIATES, INC.
Secondary School Division
155 North Wacker Drive
Chicago, IL 60606

SILICON VALLEY SYSTEMS, INC.
1625 El Camino Real, Suite #4
Belmont, CA 94002

SOFTWARE NEWS
5 Kane Industrial Drive
Hudson, MA 01749

Material: Software

SOFTWARE PUBLISHING CORPORATION
2021 Landings Drive
Mountain View, CA 94043

SOFTWARE TOOLWORKS
Walt Bilofsky, Prop.
14478 Glorietta Drive
Sherman Oaks, CA 91423

SOUTHERN MICROSYSTEMS FOR EDUCATORS
P.O. Box 1981
Burlington, NC 27215

Material: Instruction & Information Management Systems

STANDARD MICROSYSTEMS, INC.
136 Granite Hill Court
Langhorne, PA 19047

STREET ELECTRONICS CORPORATION
3152 East LaPalma Avenue, Suite D
Anaheim, CA 92806

SUPERSOFT, INC.
P.O. Box 1628
Champaign, IL 61820

SYBEX, INC.
2344 Sixth Street
Berkeley, CA 94710

Material: Computer Books

TAB BOOKS, INC.
Blue Ridge Summit,
PA 17214

TEACHER'S PET SOFTWARE
Glenn Fisher
1517 Holly Street
Berkeley, CA 94703

TECHNICAL EDUCATION RESEARCH CENTERS
8 Eliot Street
Cambridge, MA 02138

TELEPHONE SOFTWARE CONNECTION, INC
P.O. Box 6548
Torrance, CA 90504

TERAK CORPORATION
14151 North 76th Street
Scottsdale, AZ 85260

T.H.E.S.I.S.
P.O. Box 147
Garden City, MI 48135

THIRD WAVE PRODUCTS
2 Pequot Park
Canton, MA 02021

TRACE SYSTEMS, INC.
1928-A Old Middlefield Way
Mountain View, CA 94043

TRANSTAR
Box C-96975
Bellevue, WA 98009

TYCOM ASSOCIATES
68 Velma Avenue
Pittsfield, MA 01201

TYC SOFTWARE
40 Stuyvesant Manor
Geneseo, New York 14454

UNIVERSAL SYSTEMS FOR EDUCATION
2120-E Academy Circle
Colorado Springs, CO 80909

Material: Software

VERSA COMPUTING, INC.
3541 Old Conejo Road, Suite 104
Newbury Park, CA 91320

Material: Software

VESCOM ASSOCIATES
RR #1 Bruce Circle Drive
Box 135-H
Lockport, IL 60441

VISIBLE COMPUTER SUPPLY CORPORATION
3626 Stern Drive
St. Charles, IL 60174

WESTWARE SOFTWARE, INC.
2455 S.W. 4th Avenue, Suite 2
Ontario, OR 97914

WINDOW
469 Pleasant Street
Watertown, MA 02172

Will be published in book form
in Spring 1983

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RECOMMENDED REFERENCES

COMPUTING TEACHER (periodical,$14.50/yr)
c/o Computing Center
Eastern Oregon St. College
La Grande, OR 97850

This is THE periodical for teachers using computers. Includes articles about computer use in school, research, and activities & problems to use with students.

CLASSROOM COMPUTING NEWS (periodical,$16/yr)
P.O.Box 266
Cambridge MA 02138

A newcomer, issues have been full of information for beginning computer users on what computers can do, how they work, what's happening in education with computers. Content has been less use-oriented and more information-oriented than Computing Teacher.

CUE ($6/yr.,checks only)
c/0 Don McKell
Independence High School
1776 Education Park Drive
San Jose, CA 95133

CUE is a group of teachers using computers in schools, originally Bay Area, now grown to statewide. An occasional newsletter is a good source of what's happening in California. In addition, the group conducts periodic workshops and conferences which are good sources of information and good places to meet other Computer Using Educators.

BASIC AND THE PERSONAL COMPUTER
by Dwyer & Critchfield
Addison-Wesley, $13

This is the easiest, most interesting introduction to BASIC programming for teacher use, or for use with students. Chock full of interesting, useful programming problems.

BE A COMPUTER LITERATE
by Marion Ball & Sylvia Charp
Creative Computing Press, $4

A colorful and breezy introduction to computers written for kids, but can be read by teachers just getting started. A good book to have in your library at ANY school. Written to be a text for elementary computer literacy.

TEACHING BASIC BIT BY BIT
by Slesnick, et. al.
Lawrence Hall of Science, $8

This book is about the only activity-oriented introduction to computers and computer literacy available. It is written for an 8 day course, based upon the experience of LHS in working with kids and computers. Most suitable for APPLE, but for others,too.

TEACHER'S GUIDE TO COMPUTERS IN ELEM. SCHOOL
by Dave Moursund
E. Oregon St. College, $2.50

This is THE introductory book on computers for teachers. A nice feature is a chapter of computer-introduction and computer-literacy activities to do with a class with or without a computer. Interesting, thought-provoking, and easy to read, every teacher should have it!

GUIDE TO MICROCOMPUTERS
by Franz Fredrick
Assn. for Educ. Comm. & Tech. (AECT) $14.95

This complete book covers school uses in and out of the classroom, hardware, suggestions on what to look for in hardware, and possible future uses of computers in education. A thorough, well-done book.

RUNNING WILD: The Next Industrial Revolution
by Adam Osborne
Osborne/McGraw-Hill, $3.95

A lay-person's guide to the "computer revolution," with a look at the past and future of computers and their impact on society.

MINDSTORMS
by Seymour Papert
Basic Books, 10 E. 53rd St., N.Y.10022, $12.95

"Read this book first. In our opinion (Bob Albrecht) this is THE most important resource for people who wish to help kids learn to use, program, and enjoy computers." Papert is the foremost advocate of using computers as ways for kids to explore thought processes and to use as a tool for learning.

Prepared by Glenn Fisher, School Computer Specialist
Alameda County Superintendent of Schools Office

Prepared by;
Glenn Fisher
School Computer Specialist

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REFERENCES ON EDUCATIONAL BENEFITS FROM MICROCOMPUTER USE

A recent survey of research on Computer Assistence Instruction (CAI) is:

Dence, Marie "Toward Defining the Role of CAI: A Review",
Educational Technology Nov. '80
Results consistently show effectiveness of CAI in science and foreign language.
CAI Students perform better on standardized tests.
CAI with feedback resulted in greater gains than CAI without feedback.
CAI was found more effective in 45% of studies surveyed; at least as effective in 55%.
Students learn faster (up to 40%) with CAI, and retain more.
Lower level students require more time, but more students attain objectives using CAI than without; greatest pre/post test gains for students with lowest achievement.
Studies surveyed are mostly high school and college level.

Another recent article showing results with elementary students:

Esbensen, Tony "Teaching Basic Skills: Can Micros Make a Difference?"
Compute, Sept. '80 #6, 18-20
Student in bottom 25%ile Iowa test 2 yr. gain in 6 mos; scored above 50%ile.

Other studies showing results:

Sterritt, Graham "Computer as Learning Incentive"
Instructor, Aug.- Sept. '71 33-35
Computer significantly improved incentive and performance...

Oakey and Majer "Individual and Small Group Learning With CAI"
AV Comm. Review Spring '76 79-86
Up to 4 learn as much as 1 at computer

Wexler, Henrietta "Computer Literacy"
American Ed. June '79 41-42
CAI makes a difference with "academically deficient" students.

Dunn, Alex, ed. CAI Program 3 yr. Report , Montgomery City Public Schools, Rockville, MD '74 ED 100361
6th graders show significantly greater gains with CAI.
Teachers spent more time with individual students in computer-using classrooms.

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Special education students show 1.2 yr. gain in .7 yr. (p-118)
Gains were retained over summer and depend only on total time at the computer not # of sessions.
4th grade students gained 7.7 months in 4 months of 50 mins. per week of CAI.
Mentally retarded showed 7.6 months in 4 months; it took 17.8 hrs. to gain 1 year.

Kleiman, Glenn, et. al., "Microcomputers & Hyperactive Children," Creative Computing Mar. '81
Students work same speed and error rate, but stay at computer twice as long.

* * *

RECENT ISSUES - EDUCATION

AEDS
Fall '79 $10
1201 - 16th NW Suite 506
Washington, DC 20036

INSTRUCTIONAL INNOVATOR
Sept. '80 $2
AECT
1126 - 16th Street NW
Washington, DC 20036

CMLEA Journal
V3# 2 Spring '80 $2
Instructional Tech. Dept., School of Ed.
San Jose State University
San Jose, CA 95192

ED. TECHNOLOGY
Oct. '79 $6
140 Sylvan Avenue
Englewood Cliffs, NJ 07632

RECREATIONAL COMPUTING
Jan/Feb '81 $2.50
1263 El Camino Real Box E
Menlo Park, CA 94025

CREATIVE COMPUTING
Mar. '81 $2.50
Box 789-M
Morristown, NJ 07960

MATH TEACHER
Oct. '78 $2.50
1906 Association Drive
Restan, VA 22901

TEACHER
Feb. '80 $2
677 School Crest Drive
Marion, OH 43302

Prepared by:
Glenn Fisher
School Computer Specialist

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Alameda County Supt. of Schools Office
685 A. Street
Hayward, CA 94541

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COMPUTER USE IN SELF-CONTAINED CLASSROOMS

Here are some suggestions to help you get the most out of a computer if you have one, or to help you get started if you are getting one.

GET ACQUAINTED

If you haven't already spent some time with the computer, try some of the programs you plan to use and see how they work and what it can do. Using a computer is like teaching a new subject--it goes a lot smoother with some advance preparation.

LOCATION

You will be limited by the need to plug in the computer--if you have only one plug in your room, you might want to invest in a long extension cord. So you control use of the machine, it must be where you can keep an eye on it (not behind a bookcase), but it should also be out of the line of sight of most students so it does not distract them.

RULES

A computer is usually trouble-free, and a few simple rules will help keep it that way. The four suggested rules are:

1. No food or drink near the computer
2. Clean hands
3. No horseplay
4. No kibitzers (users only at your turn)

You can cut these out and tape them to the front of your computer.

SCHEDULING USE

The computer is there to help you. If it is in your way or causing problems, evaluate its role in your teaching. Don't use it when you plan whole-class instruction! You will have to decide which times are appropriate for you to have the computer available.

Educational research has shown that up to four students get the same educational benefits as one at a computer, and with several students, they can help each other and discuss what is going on. In most cases, then, you will probably want to schedule two to four students at a time at the computer.

In the classroom, computers have four basic uses, which require slightly different scheduling. The uses and suggested scheduling are:

(1) Drill and Practice--Best scheduled two--four at a time
(2) Remediation--One or two students for longer times (20-40 minutes)
(3) Enrichment--One to four on a first-come basis
(4) Simulations and Problem Solving--Two to four students at a time.

Once you have decided on a use, you can plan how to schedule students, and inform them (starting in this corner, a table at a time; today, students listed on the board, one at a time, etc.). It takes some additional time, but I think you will find it worthwhile in smoothing out classroom operation.

Computers can help your students learn, and they can be incredibly motivating. A thoughtful plan for computer use will make life easier for you.
Computers are fun--enjoy!

COMPUTERS? Advantages and Disadvantages

Research has shown increase in motivation, learning RATE, and length of retention from computer use for as little as ten minutes a day. The total time of computer use is more important than number of sessions or the schedule that is used. For use in a classroom, here are the things to remember:

ADVANTAGES

1. With proper programs, computer use motivates students to learn and behave.
2. Under some conditions students will learn more by using a computer, and they remember it longer.
3. Computers can provide individual drill for students who need it.
4. Children with problems relating to others often function better at a computer.
5. Computers can make challenging logic games and simulations available to your classroom.
6. Computers can make your teaching more effective.
7. Computers can save you time spent on record keeping.
8. Computers can help you teach by drilling, motivating, or challenging small groups of students.
9. Computers are consistent and cannot get upset.

DISADVANTAGES

1. A computer takes your time- to plan for and schedule its use.
2. A computer requires your supervision, like any other "center" or machine would.
3. A computer can distract other students.
4. Collecting and maintaining a library of programs is expensive and time-consuming.
5. A computer can only be used by a few students at a time.
6. Computers, like other machines, sometimes do not work properly.
7. You will probably want some training to most effectively use the computer.
8. You may have to rearrange your schedule if the computer is not available when you want it.

There is no question computers can help children learn. Can they help you teach? It depends on you.

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INTRODUCING THE COMPUTER TO YOUR CLASS

Directions for a teacher to use with a group of students.

1. Previous to the demonstration, load and use a tape appropriate to your class (easy & fun) so you are familiar with it.

2. At least 15 mins. prior (at recess or lunch), set up the computer and load the program. Run the program to be sure it works. Restart the program so it will be ready for your students (usually you press BREAK (RUN/STOP, RESET), then type RUN and press RETURN (ENTER).)

3. Seat the students so they can all see the screen.

4. Introduce your brand of computer.
 (with young kids, they like to say "Hello, PET" or whatever's appropriate)

5. If the students have had no prior introduction, show them the different parts of the computer:
    keyboard, t.v. screen (monitor)
    if you have them: tape recorder, disk drive, printer

(continued)

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(415) 881-6288

6. Explain what a computer can do (briefly, depending on level and interest). This can be done another time, since it doesn't require a computer.
   a) It can add numbers very fast (in 1 second, it can add as many numbers as a class of students could add in a whole school day).
   b) It can compare numbers and do something as a result--this makes a computer act "smart" or seem to "think". (example: if your score is less than 3, add 1 to the total score.)
   c) It can store huge amounts of information and get it back very quickly: a tape or floppy disk can store all the words in a 60 page book; some large computers can store all the words in all the books in a library in their memory, and find any page in less than a second!
   d) It can follow directions written for it in a language called BASIC.

7. Set down rules for using the computer:
   No food or drink, ever
   Clean hands
   Only use if its your turn
   No horseplay

8. Teach students how to use the program you've picked (here's a sample; actual instructions will vary depending on the program).
   "What is the computer asking?"(your name)
   Select a student to type in his/her name
   "Nothing is happening. why not?"
   (if students don't already know, have someone come and press RETURN (or ENTER).
   Calling on different students, go through a sample problem and response.
   Review, "What do you press to tell the computer that you're done?" (Press RETURN)

If it is appropriate, review rules or operation once more, then assign students to use the computer, and take the rest of the class off for an interesting activity (or if you have a small group, let them stay & watch), as groups of 2-4 students take their turns.

Prepared by: Glenn Fisher
School Computer Specialist
Alameda County Office of Education
685 A St., Hayward CA 94541
(415) 881-6083
5/81

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Prepared by:
Glenn Fisher
School Computer Specialist

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HIGH SCHOOL USES OF MICROCOMPUTERS

Computers can function in several capacities in the classroom. These fall generally into 2 broad categories: educational (student-oriented) and management (administrative or teacher-oriented).

EDUCATIONAL USES

1. drill and practice
2. tutorial (computer assisted instruction-CAI:providing drill with instruction)
3. simulations
4. problem solving (using programs and programming)
5. demonstration (animated graphics)
6. programming and computer literacy
7. games (motivation, enrichment)
8. testing

MANAGEMENT USES

1. testing
2. grading
3. recordkeeping (competencies, requirements)
4. class management (seating, assignments, class data)
5. statistics
6. business management-budget, mailing lists, inventory, etc.
7. word processing (writing, letters, forms)

Management uses can save teacher time and effort, allowing more time for student-contact and lesson planning. They can sometimes make new capabilities available to the teacher and administrator (statistics, budget forecasting).

EDUCATIONAL RESEARCH

Computer-assisted instruction has been shown to be at least as effective as other means of instruction, about half of all studies have found it more effective. Other results sometimes show greater retention and a more positive attitude about the subject matter covered. Usually it has been found cost effective (even 10 years ago on huge, expensive equipment). Some studies show remarkable gains: 3 years growth in 1 year, 10 minutes per day of computer time; 1 year growth in 18 hours of computer time. All studies show faster acquisition of the subject matter using computer-aided instruction. In summary, students learn faster, may learn better and remember it longer, and feel more positive about the subject when some of the material has been presented on computers.

In addition, some things are only possible with computers. Using animation, students can see graphs and conic sections in math; atoms and molecules in chemistry and physics. Word processing can't be done without a computer; simulations that are too long or complex or require difficult computations become possible, making ideas available to students.

USES AT THE HIGH SCHOOL LEVEL

By itself, a computer can only be used to teach programming. With programs (software), you can do anything you can write or buy a program for. Programs are available for

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USES AT THE HIGH SCHOOL LEVEL (continued)

many educational and management uses from many companies. They cost from $2 to $500 per program.

The following list includes only some of the educational uses in different subject areas; this list does not include management applications:

English, Foreign Language
  vocabulary, language, mechanics, style writing (word processing)
  grade compositions

Math
  graphs, statistics, solve functions, drill; write programs to solve problems; graphics, demonstration of functions, conic sections, etc.

Social Studies, History, etc.
  simulations, drill

Business
  word processing, finance, data entry, typing

Shop
  electronics, calculations, graph/picture

Psychology, Sociology
  experiment and research (medium for); statistics, word processing (reports), data processing

P. E.
  scout opponent's teams, display plays

Arts
  inventory, data storage and access (catalog) music synthesis; graphic art; choreography

Sciences
  simulations, drill, graphics, data processing from experiments, statistics

GF:ld
6/81

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Prepared by:
Glenn Fisher
School Computer Specialist
685 A St.
Hayward CA 94541
(415) 881-6083

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SOFTWARE CATALOGS & INFORMATION

These catalogs list software for several computers from many different software companies. Some catalogs simply print advertising material from the seller; others review material themselves. Prices vary as listed. "Ordering service" means you must order through them as they do not list suppliers' addresses. However, most directories list vendors' names.

APPLICATIONS SOFTWARE SOURCEBOOK Radio Shack (TRS-80)
Box 17400, Ft. Worth, TX 76102 or local store
$2.95, vendors pay to list their description

COMMODORE SOFTWARE ENCYCLOPEDIA Commodore Buss. Mach.
Syst. Marketing Group, 681 Moore Rd.,
King of Prussia, PA 19406/dealers; $9.95
lists vendors' description

EDUCATIONAL SOFTWARE DIRECTORY Sterling Swift
P.O. Box 188, Manchaca, TX 78652, $11.95
APPLE ONLY; good product description

K-12 MICROMEDIA P.O. Box 17
Valley Cottage, N.Y. 10989, $2.95
extensive list, incl. books; ordering service

MARCK 280 Linden Ave., Branford CT 06082
reviews programs; ordering service

OPPORTUNITIES FOR LEARNING 8950 Lurline Ave.
Dpt. GE390, Chatsworth, CA 91311
short descriptions; does not list vendor
ordering service (free)

QUEUE 5 Chapel Hill, Fairfield, CT 06432
reviews; ordering service; specify computer; $8.95

SCHOLASTIC 904 Sylvan Ave., Englewood Cliffs, N.J. 07632
extensive list, fair description; ordering service
(does not list vendor); free

SCHOOL MICROWARE Dresden Assoc., Box 246
Dresden ME 04342; $20/yr (4 issues)
lists vendors' addresses

Some projects which have produced software are:

CONDUIT	Box 388, Iowa City, IA 52244 center to disseminate H.S. and college progrs.
MEAN	256 N. Washington St. Falls Church, VA 22046 guidance, special education software
MECC	2550 Broadway, St. Paul, MN 55113 Apple programs, all levels; teacher's guides
Project LOCAL	200 Nahatan St., Westwood CT 02090

Some magazines carry ads for and occassionally publish reviews of educational software; they are good sources of general information about the computers and computer use in education. For more information, request the handout titled "Computer Magazines."

Users groups and their newsletters (CUE, Apple Core, etc.) are good sources of information about software. Some publish reviews of software. Request the handout "East Bay Users Groups" for information about local groups for popular computers.

All teachers should join CUE (Computer Using Educators) as the local group which provides information on software and computer-related activities in the schools. Membership is $6/yr. (checks only) to:

C.U.E.
Don McKell, Treasurer
Independence High School
1776 Education Park Drive
San Jose, CA 95133

2/82 GF

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SOURCES OF REVIEWS OF SOFTWARE

The sources listed below provide actual reviews of software, as opposed to descriptive listings. The source of the reviews is given with each source. The sources are listed in approximate order of usefulness. Where possible, the number of reviews is also given.

MACUL JOURNAL
Michigan Assn. for Computer Users in Learning
c/o Lary Smith
Wayne Intermediate School District
33500 Van Born Rd.
Wayne, MI 48184
$5
260 programs reviewed in 1980 and 1981 journals
Review includes description, source, and ratings of polish, use of computer capabilities, written documentation, ease of use, and educational value. Reviewer is Jim Winebrener, Computer Ed. Specialist for the Livorna Public Schools and 12 year veteran of high school math and computer science teaching.

SCHOOL MICROWARE REVIEWS
Dresden School Microware
Box 246
Dresden, ME, 04342
$30 for 4 issues (1 year)
50 programs per issue (approx.), first issue Sept. 1981.
Review includes description, source, comprehensive descriptive review comments in the areas of documentation in-program instructions, student-computer dialog, educational aspects, use of computer capabilities, and miscellaneous concerns. The reviewers assign numerical values which are used to compute an overall rating (0 to 10). Reviews are done by School Microware staff, and by teachers in the field.

THE JOURNAL OF COURSEWARE REVIEW (APPLE only)
The Apple Foundation
20863 Stevens Creek Boulevard
Building B-2, Suite A-1
Cupertino, CA 95014
$5.95/issue (just one so far)
17 programs reviewed in Issue #1
Reviews are descriptive prose, giving a good overall feeling for the program, while describing it and dealing with specific strengths and weaknesses. There is no set evaluation guide, but generally the topics given above are covered. Reviews are by experts and computer users in the subject and grade area of the program.

PEELINGS-2
945 Brook Circle, Dpt. C
Las Cruces, N.M. 88001
$15/yr.
This magazine is entirely devoted to reviews of Apple software.

MIDNIGHT SOFTWARE GAZETTE (PET only)
Central Illinois PET Users Group
635 Maple Ct.
Mt. Zion, IL 62549
Send stamped, self-addressed envelope for each issue, and donation. Reviews are very informal, ranging from 1 sentence to a paragraph, by members of CIPUG.

MicroSIFT
Northwest Regional Educational Laboratory
300 S.W. Sixth Ave., Portland, OR 97204
This big NSF funded project has published the first reviews. They are exceptionally thorough.

MicroSIFT, and other groups and agencies are beginning to coordinate review efforts, but have published little. Many computer education publications carry reviews of software, often done in article/descriptive style by teachers.

The San Mateo County Office of Education has available a simple, comprehensive software review form. They are collecting reviews using this form for publication through Computer Using Educators (CUE). NCTM publishes a booklet titled "Guidelines for Evaluating Computerized Instructional Materials." (1906 Association Dr., Reston, VA 22091). Dresden also has a very comprehensive review form. The Alameda County Superintendent of Schools Office has no publication containing reviews; the present intent is to publish them through the CUE Newsletter or other educational publications. Some other county offices also software review projects underway.

Prepared by Glenn Fisher, School Computer Specialist
Alameda County Superintendent of Schools Office
11/81, rev. 2/82

Prepared by;
Glenn Fisher
School Computer Specialist

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REFERENCES ON EDUCATIONAL BENEFITS FROM MICROCOMPUTER USE

A recent survey of research on Computer Assistance Instruction (CAI) is:

Dence, Marie "Toward Defining the Role of CAI: A Review"
Educational Technology Nov. '80
Results consistently show effectiveness of CAI in science and foreign language.
CAI Students perform better on standardized tests.
CAI with feedback resulted in greater gains than CAI without feedback.
CAI was found more effective in 45% of studies surveyed; at least as effective in 55%.
Students learn faster (up to 40%) with CAI, and retain more.
Lower level students require more time, but more students attain objectives using CAI than without; greatest pre/post test gains for students with lowest achievement.
Studies surveyed are mostly high school and college level.

Another recent article showing results with elementary students:
Esbensen, Tony "Teaching Basic Skills: Can Micros Make a Difference?"
Compute, Sept. '80 #6, 18-20
Student in bottom 25%ile Iowa test 2 yr. gain in 6 mos; scored above 50%ile.

Other studies showing results:

Sterritt, Graham "Computer as Learning Incentive"
Instructor, Aug.- Sept. '71 33-35
Computer significantly improved incentive and performance...

Oakey and Majer "Individual and Small Group Learning With CAI"
AV Comm. Review Spring '76 79-86
Up to 4 learn as much as 1 at computer

Wexler, Henrietta "Computer Literacy"
American Ed. June '79 41-42
CAI makes a difference with "academically deficient" students.

Dunn, Alex, ed. CAI Program 3 yr. Report , Montgomery County Public Schools, Rockville, MD '74 ED 100361
6th graders show significantly greater gains with CAI.
Teachers spent more time with individual students in computer-using classrooms.

Special education students show 1.2 yr. gain in .7 yr. (p-118)
Gains were retained over summer and depend only on total time at the computer not # of sessions.
4th grade students gained 7.7 months in 4 months of 50 mins. per week of CAI.
Mentally retarded showed 7.6 months in 4 months; it took 17.8 hrs. to gain 1 year.

Kleiman, Glenn, et. al., "Microcomputers & Hyperactive Children," Creative Computing Mar. '81
Students work same speed and error rate, but stay at computer twice as long.

* * *

RECENT ISSUES - EDUCATION

AEDS
Fall '79 $10
1201 - 16th NW Suite 506
Washington, DC 20036

INSTRUCTIONAL INNOVATOR
Sept. '80 $2
AECT
1126 - 16th Street NW
Washington, DC 20036

CMLEA Journal
V3# 2 Spring '80 $2
Instructional Tech. Dept., School of Ed.
San Jose State University
San Jose, CA 95192

ED. TECHNOLOGY
Oct. '79 $6
140 Sylvan Avenue
Englewood Cliffs, NJ 07632

RECREATIONAL COMPUTING
Jan/Feb '81 $2.50
1263 El Camino Real Box E
Menlo Park, CA 94025

CREATIVE COMPUTING
Mar. '81 $2.50
Box 789-M
Morristown, NJ 07960

MATH TEACHER
Oct. '78 $2.50
1906 Association Drive
Restan, VA 22901

TEACHER
Feb. '80 $2
677 School Crest Drive
Marion, OH 43302

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6/81

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CHOOSING A MICROCOMPUTER

Which One Should I Buy?

You'll be spending a lot of money. It's important you make a good choice so the computer you buy meets your needs and expectations, and gets used. The criteria listed for selection are approximately in order of importance.

1. WHAT IS YOUR USE?
Are you teaching programming, or using it for word processing, drill, or keeping track of grades or competencies? Some uses are available on only a particular microcomputer; other tasks can be done by any model. You must be sure the one you choose supports your use. If you plan to set up a computer lab, you also will need a network to load programs into all your machines.

2. WHAT ARE OTHERS IN YOUR DISTRICT USING?
This is important because it provides you with a source of support and information, and leverage. A district with a mixture of machines will be unable to provide adequate support to all of them. The ability to interchange parts, to share information on uses and problems, and to set up common libraries of software, are important as you start using your computer.

3. WHAT SOFTWARE IS AVAILABLE?
If you want to write your own programs, or simply teach programming, this is not a factor. For the other 95% of uses, it is crucial. Check through a computer store or software catalog what is available for the uses you plan so you don't end up with a $1000 paperweight.

4. WHAT CAN YOU AFFORD?
If you only have $1000, it's ridiculous to buy part of a $2000 computer and hope to get money to buy the rest later. For computer literacy or drill, your goal may be to get as many students as possible to the computer; many inexpensive computers will be your choice. However, if you need a business type word processor for a business class, you probably want to buy a specific word processor rather than try and make another computer act like something it isn't.

COMPARING POPULAR MICROCOMPUTERS

Name	Cost of* System	Software available	Advantages	Disadvantages
APPLE	16K, tape b&w $1500.	much	Author languages, PASCAL, compatability with CP/M and time-share, LOGO. Hi-resolution color graphics, sound and speech capability	programmer-oriented; expensive; tape-load problems; use requires memorizing key combinations for editing.
ATARI	8K, tape, b&w, $1000, 16K, disc, color, $2000	little	second-generation; sound, hi-resolution color graphics, plug-in modules, PILOT	programmer-oriented; short time on market-few users and little software, pieces

COMPARING POPULAR MICROCOMPUTERS (continuation)

Name	Cost of * System	Software available	Advantages	Disadvantages
Ohio Scientific	8K, tape, b&w $600 32K, disc, color $2000	little	8K machine cheap; fast basic.	Few users and little software.
PET	16K, tape b&w $1000	fair	easy to use, user-oriented; one case-portability; very clear screen; editing ease; reliability of tape unit.	Lack of service support, policy changes by Commodore, non-standard key placement on keyboard.
Radio Shack TRS-80	16K, tape, b&w, $1000	much	Model III one-case-portability, fast tape speed & reliability; service and number of outlets; Company policy supporting education.	Incompatability of Level I & II & color computer; programmer-oriented; poor graphics, screen editing requires memorizing codes; Mod I many pieces, trouble reading & saving tape.
Sinclair	1K, tape b&w $400	none	cheap	Inflexible, no programs, small memory, flat keyboard.
Texas Instruments 99/4	16K, tape, b&w $1500	very little	speech capability plug-in modules, LOGO	Non-standard keyboard size, new to market-few users and little software

* Some computers (Apple, Atari, Sinclair) come only as a keyboard/computer; tape recorder or disc and TV must also be bought. Note that 16k with tape and b & w TV is within a few dollars of $1000 for most machines.

+ Programmer-oriented - The machine is designed for use by programmer; usually requires additional steps to use programs or program in BASIC: additional memorization of codes to operate.

What Should I Budget For Software?

When planning to purchase a computer for any use except programming, you must also plan to buy software (programs). Depending on your use, this can cost you from $100 to more than $1000.

For a single subject (decimals, physics, Spanish), $200 to $500 is a reasonable amount to spend. For multiple subject use (elementary, school, other), $500-$1000 will be necessary to establish a quality, useful library of programs.

Why so much? You've invested a lot in your computer. Poor quality programs, or little choice, will lead to dissatisfaction and lack of use. There are lots of programs available in the public domain, but they tend to be low quality and mostly games. You'll still spend money on tapes or discs, plus time to copy them, so they are not free.

For more information on computers or software, to arrange a demonstration at the County Office, or a visit to your school, contact:

Glenn Fisher, School Computer Specialist
Alameda County Superintendent of Schools Office
685 A Street
Hayward, CA 94541
(415) 881-6083

GF:dap

SCHOOL COMPUTER SPECIALIST
ALAMEDA CO. SUPERINTENDENT OF SCHOOLS
685 A STREET
HAYWARD, CA 94541

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Will be published in book form in
Spring 1983

SOURCES OF 5 1/4" DISKS (MAIL ORDER)

ABM PRODUCTS
8868 Clairemont Mesa Blvd.
San Diego, CA 92123
(714) 268-3537

WABASH	10/$23
MAXELL SS/SD	10/$33
DS/SD	10/$42.50

(6% tax + min $2 S&H)

FUTRA COMPANY
P.O. BOX 4380 Dept.I
Torrance, CA 90510
(213) 328-8951

SCOTCH	10/$27

(6% tax + min $3 S&H)

BETA COMPUTER DEVICES
1230 W. Collins Avenue
Orange, CA 92668
(714) 633 - 7280

WABASH SS/SD	10/$27.95
SS/DD	10/$29.95

(6% + $3 S&H)

MICRO BUSINESS WORLD
18720 Oxnard Suite 108
Tarzana, CA 91456
(213) 996-2252

DYSAN SS/SD #104-1	10/$45

(6% tax + 2% S&H)

PACIFIC EXCHANGES
100 Foothill Boulevard
San Louis Obispo, CA 93401
(800) 592-5935 or (800) 543-1037

Call for prices and information on DYSAN, MAXELL, SCOTCH, WABASH, MEMOREX, VERBATIM.

AB COMPUTERS
252 Bethlehem Pike
Colmar, PA 18915
(215) 822-7727

SCOTCH	10/$28.50
VERBATIM (DATALIFE)	10/$24.50

I recommend double density (DD) for PET & APPLE DOS 3.3. I do not recommend "double siding" disks - if you must, buy double side disks (DS/DD)

SOURCES OF TAPES

AGS
30998 Huntwood Avenue
Hayward, CA 94544

C-10 10/$8.60 - 50/$39
(low noise Phillips box)
C-10 100/$54- (bulk no boxes)

AB COMPUTERS
(see address under Disks above)

C-10 10/$5.65 - 50/$25
(high output, low noise)

MICROSETTE
475 Ellis Street
Mt. View, CA 94043 (415) 968-1604

C-10 10/$7.50 - 50/$32.50
250/$125 pp or $137.50 net 30 days
Phillips box

GF:1d

CALIFORNIA LIBRARY MEDIA CONSORTIUM FOR

CLASSROOM EVALUATION OF MICROCOMPUTER COURSEWARE

FOLD HERE AND STAPLE TO RETURN ADDRESS ON REVERSE)

- -

Program title______________________________________

Disk/tape/package title (if different)__________________________

Microcomputer brand, model________________________ ___K memory needed

Language __BASIC (or________) Publisher__________________ Cost________

Peripherals needed____________ __Disk __Tape __Cartridge __Other(________________)

Supplemental materials/equipment needed____________________ Backup possible?_______

* * * * * * * * * * * * * * *

Reviewed by______________________________ grade level/subject___________

School/District______________________________ Phone (___)___________

Address____

May we use your name in the published review?__________________________

THANK YOU FOR YOUR HELP. PLEASE RETURN IMMEDIATELY TO THE ADDRESS ON THE BACK.

CHECKLIST OF EVALUATION CRITERIA

YES NO N/A

GENERAL:

___ ___ ___ 1. Is this an effective/appropriate use of the computer?

___ ___ ___ 2. Are the objectives/purpose of the program well defined?

___ ___ ___ 3. Does the program achieve its objectives/purpose?

___ ___ ___ 4. Is the program technically sound, free of programming errors, easy to operate?

___ ___ ___ 5. Does it provide a useful summary or report of student performance?

___ ___ ___ 6. Is the program free of excessive competition and violence?

___ ___ ___ 7. Is it free of racial, sex, and ethnic stereotypes?

___ ___ ___ 8. Is the documentation sufficient?

CONTENT:

___ ___ ___ 1. Is the content factually correct?

___ ___ ___ 2. Is the presentation logical, well organized, with internal consistency?

___ ___ ___ 3. Can the instructor modify the program (word lists, data, speed, etc.)?

___ ___ ___ 4. Are the interest level, difficulty level and vocabulary level compatible?

INSTRUCTIONS (available within the program)

___ ___ ___ 1. Are they clear, complete and concise?

___ ___ ___ 2. Can user skip them and return to them as needed (HELP)?

___ ___ ___ 3. Is user told how to end program? start over? reenter where user left?

___ ___ ___ 4. Can user control speed and sequence of paging?

___ ___ ___ 5. Is there a menu to allow user to access specific parts of the program?

INPUT:

___ ___ ___ 1. Is input consistent, using common conventions and symbols?

___ ___ ___ 2. Can user correct input if necessary before continuing program?

___ ___ ___ 3. Is there a cursor or other indicator to show where input is to go?

___ ___ ___ 4. Does the computer give a helpful response to input errors?

___ ___ ___ 5. Is the amount of typing required appropriate to the grade level?

SCREEN OUTPUT:

___ ___ ___ 1. Is the screen format neat and uncluttered?

___ ___ ___ 2. Are punctuation and grammar correct?

___ ___ ___ 3. Is the correct answer, or appropriate help, given after a reasonable time or after a given number of errors?

___ ___ ___ 4. Does the program branch to easier or harder material in response to user input?

___ ___ ___ 5. Are responses to errors non-judgmental, free of harsh or demeaning comment?

___ ___ ___ 6. Is the positive feedback for correct response more interesting/enjoyable/exciting than is the response to errors/failure?

___ ___ ___ 7. Does the program use motivational devices effectively?
CIRCLE those used. STAR (*) ones used effectively to enhance the program.
__timing __scoring __game format ___personalization __color __sound
__graphics for instruction __graphics for reward __random order

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GRADE LEVEL(S) (circle) k 1 2 3 4 5 6 7 8 9 10 11 12 college teacher use

SUBJECT AREA(S)______________________________

SCOPE

__single concept program
__program is one part of a larger instructional series
__complete instructional unit

GROUP SIZE

__individual use
__small group (2 to 5)
__large group/class

DOCUMENTATION

__in program
__guide/manual
__student materials
__none

TYPE OF PROGRAM

__simulation (a model of a portion of the real world)
__educational game
__game
__drill and practice
__tutorial (presents new material for student to learn)
__problem solving
__testing
__authoring system (allows teacher to develop a program)
__classroom management
__other ______________________

BRIEF DESCRIPTION OF THE PROGRAM

Objectives______________________________

Content______________________________

Classroom uses______________________________

Strengths/weaknesses______________________________

STUDENT RESPONSE

Did your students like the program?______________________

Did they want to use the program repeatedly, or share it with friends?______________

Did they learn from it?______________________

PLEASE USE ANOTHER SHEET IF YOU HAVE ADDITIONAL COMMENTS

OVERALL OPINION ***** OVERALL OPINION ***** OVERALL OPINION ***** OVERALL OPINION

__Great program! I recommend it highly!
__Pretty good/useful -- consider purchase.
__OK, but you might wait for something better.
__Not useful. I don't recommend purchase.

TO:

Ann Lathrop
San Mateo County Office of Education
333 Main Street
Redwood City CA 94063

1/82

NATIONAL COUNCIL OF
Teachers of Mathematics
1906 Association Drive, Reston, Virginia 22091 ■ (703) 620-9840

COMPUTER INFORMATION RESOURCES

In the ARITHMETIC TEACHER (AT) -- For Elementary School Teachers

Gress, Eileen K. "A Computer-Literacy Module for the Junior High School." ARITHMETIC TEACHER 29 (March 1982):46-49.

Hatfield, Larry L. "A Case and Techniques for Computers: Using Computers in Middle School Mathematics." ARITHMETIC TEACHER 26 (February 1979): 53-55.

Laycock, Mary. "ADAM Comes to Nueva." ARITHMETIC TEACHER 27 (January 1980): 46-47.

Makurat, Phillip A. "A Look at a Million." ARITHMETIC TEACHER 25 (December 1977):23.

Martin, Kathleen. "The Learning Machine." ARITHMETIC TEACHER 29 (November 1981):41-43.

Rubillo, James M. "One Point of View." ARITHMETIC TEACHER 29 (October 1981):2.

Scott, Thomas L. "A Different Attribute Game." ARITHMETIC TEACHER 28 (March 1981): 47-48.

Statz, Joyce A. "Compu-Kids: A Project for 'Children' of All Ages." ARITHMETIC TEACHER 25 (May 1978):48-50.

Tabler, M. Bernadine, and Marilyn Hall Jacobson. "IDEAS." ARITHMETIC TEACHER 28 (May 1981):19-24.

"What's Going On." ARITHMETIC TEACHER. (Monthly Feature.)

Wiebe, James H. "BASIC Programming for Gifted Elementary Students." ARITHMETIC TEACHER 28 (March 1981):42-44.

Winner, Alice Ann, and Margo D. McClung. "Computer Game Playing--"Turn-On" to Mathematics." ARITHMETIC TEACHER 29 (October 1981):38-39.

Zukas, Walter X., L. H. Berka, and Judith T. Martin. "Teaching Fourth and Fifth Graders about Computers." ARITHMETIC TEACHER 28 (October 1980):24-27.

In the MATHEMATICS TEACHER (MT) -- For Secondary School Teachers

Allison, Joe Frank. "Polar Coordinates and Computer-linked Plotters." MATHEMATICS TEACHER 70 (February 1977):166-69.

Anderson, Ronald E., Daniel L. Klassen, and David C. Johnson. "In Defense of a Comprehensive View of Computer Literacy--a Reply to Luehrmann." MATHEMATICS TEACHER 74 (December 1981):687-90.

Baker, Thomas B. "Sketching the Curve $y = x \sin 1/x$." MATHEMATICS TEACHER 72 (February 1979):129-31.

Battista, Michael T. "Formal Axiomatic Systems and Computer—Generated Theorems." MATHEMATICS TEACHER 75 (March 1982):215-20.

Blaisdell, Fred and Art Indelicato. "Finding Chord Factors of Geodesic Domes." MATHEMATICS TEACHER 70 (February 1977). 117-24.

Bruce, William J. "Crazy Roller Coasters." MATHEMATICS TEACHER 71 (January 1978):45-49.

Carpenter, Thomas, Mary Kay Corbitt, Henry S. Kepner, Jr., Mary Montgomery Lindquist, and Robert Reys. "The Current Status of Computer Literacy: NAEP Results for Secondary Students." MATHEMATICS TEACHER 73 (December 1980):669-73.

Cieply, Joseph, and J. Kevin McCoy. "Real-Eee.....!" MATHEMATICS TEACHER 69 (April 1976):268-70.

Cohen, David B. "Another Way of Finding Prime Numbers." MATHEMATICS TEACHER 69 (May 1976):398-400.

Computers and Calculators (MT, May 1978). #273. $3.50. Provides practical ideas for using calculators and addresses important questions about computers.

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Dolan, Daniel T. "Some Irrational Results with Irrational Numbers." MATHEMATICS TEACHER 74 (April 1981):258-61.

Dugdale, Sharon. "Green Globs: A Microcomputer Application for Graphing of Equations." MATHEMATICS TEACHER 75 (March 1982): 208-14.

Duncan, Richard B. "The Golf Tee Problem." MATHEMATICS TEACHER 72 (January 1979):53-57.

Dunn, Samuel L., and Lawrence W. Wright. "Models of the U.S. Economy." MATHEMATICS TEACHER 70 (February 1977):102-10.

Dunn, Samuel L., Ruth Chamberlain, Patricia Ashby, and Kenneth Christensen. "People, People, People." MATHEMATICS TEACHER 71 (April 1978):283-91.

Folk, Mike. "Should Your School Get a Microcomputer?" MATHEMATICS TEACHER 71 (October 1978):608-13.

Gabai, Hyman. "Graphcodes." MATHEMATICS TEACHER 69 (April 1976):276-79.

Hay, Louise. "Using the Computer to Help Prove Theorems." MATHEMATICS TEACHER 4 (February 1981):132-38.

Heintz, Ruth E. "It's in the Bag." MATHEMATICS TEACHER 70 (February 1977):132-36.

Heiny, Robert L. "Gambling, Casinos, and Game Simulation." MATHEMATICS TEACHER 74 (February 1981):139-43.

Hollist, J. Taylor. "The Fifteen Puzzle." MATHEMATICS TEACHER 72 (November 1979):603-7.

Hutcheson, James W. "Computer-assisted Instruction Is Not Always Drill." MATHEMATICS TEACHER 73 (December 1980):689-91, 715.

Johnson, David C., Ronald E. Anderson, Thomas P. Hansen, and Daniel I. Klassen. "Computer Literacy--What Is It?" MATHEMATICS TEACHER 73 (February 1980):91-96.

Johnsonbaugh, Richard. "Applications of Calculators and Computers to Limits." MATHEMATICS TEACHER 69 (January 1976):60-65.

Keller, Clifton. "Using Tables to Teach Mathematics." MATHEMATICS TEACHER 71 (November 1978):655-56.

Kennedy, Jane B. "Graphing Polynomials with Computer Assistance." MATHEMATICS TEACHER 74 (October 1981):516-19.

Landry, Michael. "Algebra and the Computer." MATHEMATICS TEACHER 73 (December 1980):663-67.

Lappan, Glenda, and Mary Jean Winter. "Some Problems with Fractions for the Middle School." MATHEMATICS TEACHER 74 (February 1981):102-4, 143.

________. "A Unit on Slope Functions--Using a Computer in Mathematics Class." MATHEMATICS TEACHER 75 (February 1982):118-22.

Leonard, William A., and David L. Pagni. "A Computer Meets a Classical Problem." MATHEMATICS TEACHER 73 (March 1980):207-12.

Luehrmann, Arthur. "Computer Literacy--What Should It Be?" MATHEMATICS TEACHER 74 (December 1981):682-86.

Lund, Charles. "Pascal's Triangle and Computer Art." MATHEMATICS TEACHER 72 (Februay 1979):170-84.

Manhard, Warren B. 2d. "Is Exponentiation Commutative?" MATHEMATICS TEACHER 74 (January 1981):56-60. See also October, 501.

Mathers, Jolly. "The Barber Queue." MATHEMATICS TEACHER 69 (December 1976):680-84.

McCabe, John, and Marshall R. Ransom. "Trial and Error--ADAMS, BETTR, BEST." MATHEMATICS TEACHER 72 (May 1979):348-50.

McCaig, Duncan A., and Lars C. Jansson. "A School Computer Network." MATHEMATICS TEACHER 71 (November 1978):694-97.

Metz, Jim. "When Will We Meet Again? A Modified Answer." MATHEMATICS TEACHER 70 (January 1977):41-45.

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Microcomputers (MT, November 1981). #203. $3.50. A special issue on computers in mathematics education that may be useful to some as a guide to getting started and to others as an update of the current status. Includes an annotated bibliography of related materials and computer organizations.

****

Muller, Richard C. "An Investigation of Integral 60 and 120 Triangles. MATHEMATICS TEACHER 70 (April 1977):315-18.

"NEW PRODUCTS, NEW PROJECTS, NEW PUBLICATIONS." MATHEMATICS TEACHER (monthly feature). In the yearly index of the MATHEMATICS TEACHER (December) is included the heading "Computers and Calculators" under which are listed articles and the page numbers of computer materials that were reviewed in NEW PRODUCTS, NEW PROJECTS, NEW PUBLICATIONS.

Noble, John W. "Computerized Testing: A New System of Evaluation." MATHEMATICS TEACHER 74 (May 1981):385-87.

Norris, Donald O. "Let's Put Computers into the Mathematics Curriculum." MATHEMATICS TEACHER 74 (January 1981):24-26. See also September, 410; October, 499-500.

Obermeyer, Dean D. "Another Look at the Quadratic Formula." MATHEMATICS TEACHER 75 (February 1982):146-52.

Peele, Howard. "Teaching Mathematics via APL (A Programming Language)." [illegible] TEACHER 72 (February 1979):97-116.

Shilgalis, Thomas W. "Geometric Transformations on a Microcomputer." MATHEMATICS TEACHER 75 (January 1982):16-19.

Snover, Stephen L., and Mark A. Spikell. "The Role of Programmable Calculators and Computers in Mathematical Proofs." MATHEMATICS TEACHER 71 (December 1978):745-50.

Spencer, Marilyn J. "Computer Clubs = Computer Education Programs." MATHEMATICS TEACHER 75 (March 1982):234-35.

Strauss, Aaron. "ENIAC: The First Computer." MATHEMATICS TEACHER 69 (January 1976):66-72.

Stover, Donald W. "Where Do These Numbers Come From?" MATHEMATICS TEACHER 73 (April 1980):288-94.

Young, Courtney D., Jr. "X-Game--Some Consequences." MATHEMATICS TEACHER 72 (January 1979):5-8.

Zabinski, Michael P., and Benjamin Fine. "A Computer Discovery Approach for Quadratic Equations." MATHEMATICS TEACHER 72 (December 1979):690-94.

Additional information may be found in the annual indexes for each journal.
Cumulative indexes for the MT and the AT are available from the Council.

Articles from the JOURNAL FOR RESEARCH IN MATHEMATICS EDUCATION (JRME)

Alspaugh, Carol Ann. "Identification of Some Components of Computer Programming Aptitude." JOURNAL FOR RESEARCH IN MATHEMATICS EDUCATION 3 (March 1972):89-98.

Alspaugh, John W. "The Relationship of Grade Placement to Programming Aptitude and FORTRAN Programming Achievement." JOURNAL FOR RESEARCH IN MATHEMATICS EDUCATION 2 (January 1971):44-48.

Hatfield, Larry, and Thomas E. Kieren. "Computer-assisted Problem Solving in School Mathematics." JOURNAL FOR RESEARCH IN MATHEMATICS EDUCATION 3 (March 1972):99-112.

Jerman, Max. "Some Strategies for Solving Simple Multiplication Combinations." JOURNAL FOR RESEARCH IN MATHEMATICS EDUCATION 1 (March 1970):95-128.

Johnson, David C., and Robert D. Harding. "University Level Computing and Mathematical Problem-solving Ability." JOURNAL FOR RESEARCH IN MATHEMATICS EDUCATION 10 (January 1979):37-55.

Keats, John B. "A Reply to Kulm." JOURNAL FOR RESEARCH IN MATHEMATICS EDUCATION 4 (May 1973):190-92.

Keats, John B., and Duncan N. Hansen. "Definitions and Examples as Feedback in a CAI Stimulus-centered Mathematics Program." JOURNAL FOR RESEARCH IN MATHEMATICS EDUCATION 3 (March 1972):113-122.

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Kraus, William H. "Using a Computer Game to Reinforce Skill in Addition to Basic Facts in Second Grade." JOURNAL FOR RESEARCH IN MATHEMATICS EDUCATION 12 (March 1981):152-55.

Kulm, Gerald. "Some Problems in a Study of CAI Feedback." JOURNAL FOR RESEARCH IN MATHEMATICS EDUCATION 4 (May 1973):187-89.

Article Reprints

Reproduction of individual articles that have been published in NCTM periodicals are available for $1.25 per title. Send remittance with specific quantity/title/journal month and year to Reprint Service, NCTM. Quantity pricing available on request.

Back Issues

Copies of the AT, MT and JRME are available for $3.50 an issue from the Back Issues Department, NCTM, 1906 Association Drive, Reston VA 22091.

To purchase bound volumes of the NCTM journals, write to AMS Press, 56 E. 13th St., New York, NY 10003, for price list and order blank. To purchase microfilm volumes of NCTM journals, write to University Microfilms, 300 North Zeeb Rd., Ann Arbor, MI 48106 for current prices.

In NCTM Publications

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COMPETENCIES FOR TEACHERS

According to the Association for Computing Machinery, EVERY teacher should have minimal computer competencies. They should

1. be able to read and write simple programs that work correctly and to understand how program and subprograms fit together into systems

2. have experience using educational application software and documentation

3. have a working knowledge of computer terminology, particularly as it relates to hardware

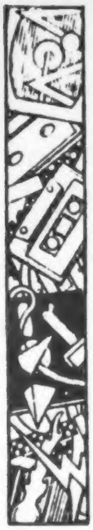
4. know by example, particularly in using computers in education, some types of problems that ARE and some general types of problems that ARE NOT currently amenable to computer solution

5. be able to identify and use alternate sources of current information on computing as it relates to education

6. be able to discuss at the level of an intelligent layperson some of the history of computing, particularly as it relates to education

7. be able to discuss moral or human-impact issues of computing as they relate to societal use of computers generally, and educational use specifically.

eprinted from a handout created by an instructor at Illinois State University.



THE ELECTRONIC LEARNING SOFTWARE DIRECTORY

A Guide to 200 Producers of Educational Programs

"AS THE SOFTWARE GOES, SO GO THE FORTUNES OF EDUCATIONAL COMPUTING." THIS IS THE REFRAIN WE AT *EL* HAVE BEEN HEARING SINCE WE BEGAN WORK ON OUR PREMIER ISSUE, ONE YEAR AGO. "THE HARDWARE IS AVAILABLE. STUDENTS ARE EAGER. TEACHERS ARE EXCITED BUT UNTIL THERE'S A LARGE POOL OF HIGH-QUALITY SOFTWARE . . . ."

EL's *Software Directory* should help dispel at least half of that common complaint—that at present, there is only a limited range of software available that is applicable for the classroom or school administrator's office. The *Directory*, which was culled from exhaustive searches of the literature, reports from educators, and press releases from *EL*'s own software files, lists more than 200 vendors of educational software. Besides the company names and addresses, the *Directory* also offers a quick rundown of the kinds of programming each firm has available, and for which grade levels; which machines the software can run on; and a general price range. Current information was obtained through telephone calls to each company. Those who could not be reached by phone are listed by name only.

The *Directory*, of course, should not be viewed as a qualitative listing; we made no judgments of any kind in this area. But it can serve as a fairly comprehensive "starter" resource for finding those companies whose products match your needs, your brand of computer, and your price range.

Once you've found a product you may be interested in purchasing, there are a variety of ways you can "test" it before actually handing over the check. They include:

- **Word of Mouth.** Possibly your most trustworthy resource.
- **Reviews in Educational Journals.** Often the software vendor can tell you where its products were reviewed. You might write to specific journals for a list of programs they have reviewed, as well.
- **The Software Vendor.** Ask the vendor for the results of any classroom field-testing that may have been done with the software you're interested in. You might also ask for the names of some educator-users of the product, whom you can call for more information.

Check around; compare different programs before making your decision. (That's just one of the ways the *EL Directory* might come in handy.) And, as you do find programs that truly answer your needs—tell us about them. We'll let other educators know about the software that has worked for you, next year in the pages of *EL*.

Illustration by Doug Taylor

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A

AB COMPUTERS
252 Bethlehem Pike, Colmar PA 18915; (215) 822-7727

Programs: music writing program; grades 6-12
Machines: Commodore PET
Price: $60

ACORN SOFTWARE PRODUCTS, INC.
634 N. Carolina Ave. S.E., Washington, D.C. 20003; (202) 544-4259

Programs: foreign language series; grades K-12
Machines: TRS-80 (Models I and III)
Price: $29.95

ACTIVITY RESOURCES, INC.
P.O. Box 4875, Hayward, CA 94540; (415) 782-1300

Programs: 36 in math instruction (includes fractions, factoring and "arithmagic" games); grades 2-12
Machines: TRS-80 and Apple II
Price Range: $35-$175

ADDISON-WESLEY PUBLISHING COMPANY
2725 Sand Hill Road, Menlo Park, CA 94025; (415) 854-0300

Programs: math games and graphing experiments; grades 1-12. Also, three new administrative programs, "Bursar," "Equip," and "Purchase".
Machine: Apple II
Price Range: in sets, $120-$270 or $45 each

ADVANCED OPERATING SYSTEMS
450 St. John Road, Michigan City, IN 46360; (219) 879-4693

Programs: "Time Dungeon" American history lesson in game format; and "Mostly BASIC," a mix of programs; grades 9-12
Machines: TRS-80 (Models I and III) and Apple II Plus
Price Range: $21.95-$29.95

AFTERMATH SOFTWARE
15316 Gulf Blvd. #204, Madeira Beach, FL 33708; (813) 393-4887

Programs: nine in graphics application; grades 9-12
Machines: TRS-80 (Models I and III)
Price Range: $12.95-$14.95

APPLE COMPUTER, INC.
10260 Bandley Drive, Cupertino, CA 94017; (408) 996-1010

Programs: problem solving and spelling, grades 1-8; a spelling dictionary, grade 4; geography, grade 6; geometry, grade 7; music theory and composition, junior high; also, new Apple LOGO
Machines: Apple II, II Plus and III
Price Range: $50-$200

APPLIED EDUCATIONAL SYSTEMS
R.F.D. #2, Box 213, Dunbarton, NH 03301; (603) 774-6151

Programs: administrative only (includes grade reporting, test reporting, scheduling, and attendance); grades 1-12
Machines: any microcomputer with CPM
Price Range: $9.95-$14.95

ASK ENTERPRISES
825 W. Rosewood St., Rialto, CA (714) 874-2085

Programs: 30 programs in English, reading and spelling; grades 1-6
Machines: TRS-80 (Models I and III)
Price Range: $20-$25

ATARI INC.
1272 Borregas Ave., Sunnyvale, CA 94086; (408) 745-2000

Programs: "Invitation to Programming," foreign languages, statistics, music, games; grades K-12
Machines: Atari 400 and 800
Price Range: $14.95-$59.95

AUTOMATED SIMULATIONS
1988 Leghorn Street, Mountain View, CA 94043; (415) 964-8021

Programs: "Jabbertalky," word game; grades 3-12
Machines: Apple II and TRS-80 (Models I and III)
Price: $29.95

AVANT-GARDE CREATIONS
P.O. Box 30160, Eugene, OR 97403; (503) 345-3043

Programs: various creativity packages, a teacher grading tool, and an authoring system. Company will also market a teacher's own courseware. Grades 1-12
Machines: Apple II
Price Range: $19.95-$29.95; the authoring system is $250

AVAS CORP.
196 Holt St., Hackensack, NJ 07602; (800) 631-0868

Programs: math, reading, social studies, spelling and computer literacy; grades K-6
Machine: APF (Imagination)
Price Range: $29.95-$79.95

B

BOB BAKER
5845 Topp Court, Carmichael, CA 95608; (916) 482-7771

Programs: 37 in business education and math; grades 8-12
Machines: TRS-80 (Models I and III)
Price Range: $19-$35

BASICS AND BEYOND INC.
P.O. Box 10, Amawalk, NY 10501; (914) [illegible] 2355

Programs: 80 in math, spelling, vocabulary and geography; grades 5-12
Machines: TRS-80 (Models I and III)
Price Range: $14.95-$29.95

B & B SOFTWARE
P.O. Box 2080, Ann Arbor, MI 48106; (313) 668-8152

Programs: an administrative package designed especially for counselors (includes scheduling, appointments, etc.)
Machines: TRS-80 (Models I and III)
Price: $195

BCD ASSOCIATES
1216 N. Blackwelder Ave., Oklahoma City, OK 73106; (405) 524-7403

Programs: "The Instructor" — a courseware authoring system, to be used with video recorder interface
Machines: Apple II and Apple II Plus
Price: $395

BEAGLE BROTHERS MICRO SOFTWARE
4315 Sierra Vista, San Diego, CA 92103; (714) 296-6400

Programs: nine in BASIC computer language and programming; grades 7-12
Machines: all Apple computers
Price Range: $24-$39.50

BEHAVIORAL ENGINEERING
230 Mt. Hermon Road #207, Scotts Valley, CA 95066; (408) 438-5649

Programs: three programs in spelling, math and composition, using visualization techniques; grades preschool-12
Machine: Apple II
Price Range: $50-$75

BELL & HOWELL
7100 N. McCormick Road, Chicago, IL 60645, (312) 328-8100

Programs: "Genis," an authoring system for teachers without programming skills
Machine: any Apple-based system (including Bell & Howell's own microcomputer)
Price: $300

JOHN BERARD
235 Mesa Ave., Newbury Park, CA 91320; (805) 498-7533

Programs: an algebra tutor; grades 7-9
Machines: TRS-80 (Models I and III)
Price: $15.95

BERTAMAX, INC.
Suite 500, 101 Nickerson St., Seattle, WA 98109; (206) 282-6249

Programs: language skills, reading, math skills and games, algebra, a time series and programs for the handicapped; grades K-8
Machines: Apple and TRS-80
Price Range: $17-$99.50

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BLUE LAKES COMPUTING

3240 University Ave., Madison, WI; (608) 233-6502

Programs: statistics and graphic analysis of data; 9-12 and administrative

Machines: Apple II and III

Price Range: $100-$250

BORG-WARNER EDUCATIONAL SYSTEMS

600 W. University Drive, Arlington Heights, IL 60004; (312) 394-1010 or (800) 323-7577

Programs: a word structure package for grades 3-6 and a college preparatory program for high school students

Machine: Apple II

Price Range: $600-$1.450

BPI SYSTEMS, INC.

1600 West 38th Street, #114, Austin, TX 78731; (512) 454-2801

Programs: various administrative packages, including accounting

Machines: Apple, Commodore PET, NEC, and IBM

Price Range: $395-595

BRAIN BOX

601 W. 26th St., New York, NY 10001; (212) 989-3573

Programs: social studies, language and reading skills, science, and American history; grades 4-12

Machine: Commodore PET

Price Range: $50-$80

HAL BROENKOW

8511 226th S.W., Edmunds, WA 98020; (206) 774-1071

Programs: math drills, classroom management systems, and a "Trigonometry Tutor" program that uses Pilot; grades 8-12

Machines: TRS-80 (Models I and III)

Price Range: $15-$30

CALIFORNIA SOFTWARE

P.O. Box 275, El Cerrito, CA 94530; (415) 527-8717

CHARLES MANN & ASSOCIATES

55722 Santa Fe Trail, Yucca Valley, CA 92284; (714) 365-9718

Programs: administrative only, including budget, grading, and scheduling packages; also, a word processor

Machine: Apple,TRS-80 and IBM micros

Price Range: $49.95-$299.95 (until Aug. 1)

THE CODE WORKS

Box 550, Goleta, CA 93116; (805) 683-1885

Programs: various tutorial skills and a group of educational games; grades 1-12

Machines: Commodore PET, VIC-20 and Atari.

Price Range: $4.95-$15.95

COMPU-ED

920 N.W. 179 Terrace, Miami, FL 33169; (305) 652-6120

Programs>seven multiplication drills; grades 1-8

Machines: TRS-80 (Models I and III)

Price: $20

COMPUMAX

P.O. Box 1139, Palo Alto, CA 94301; (415) 854-6700

Programs: a sales and accounting primer and a lesson-writing system; high school

Machine: Atari 800

Price Range: $39.95-$350

COMM—DATA SYSTEMS

P.O. Box 325, Milford, MI 48042; (313) 685-0113

Programs: English, reading, math, geometry and educational games; grades K-8

Machines: Commodore PET and VIC-20

Price: $7.[illegible]

COMPRESS (A DIVISION OF SCIENCE BOOKS INTERNATIONAL)

P.O. Box 102, Wentworth, NH 03282; (603) 764-5831

Programs: mostly administrative, including attendance and grading packages

Machines: Apple II and Apple II Plus

Price Range: $250-$350

COMPU-TATIONS

P.O. Box 502, Troy, MI 48099; (313) 524-2317

Programs: "create a quiz," spelling games, math skills, typing and administrative; grades 1-10. Some programs available for preschool.

Machine: Apple II

Price Range: $14.95-$29.95

COMPUTER ADVANCED IDEAS, INC.

Suite 341, 1442A Walnut St., Berkeley, CA 94709; (415) 526-9100

Programs: a game show and mini-authoring program with a vocabulary focus; grades 1-10

Machine: Apple

Price: $39

COMPUTER ASSISTED INSTRUCTION, INC.

6115 28th St. S.E., Grand Rapids, MI 49506; (616) 942-2892

Programs: reading; grades 1-12. By Sept. '82, a high school equivalency reading comprehension program (GED completion).

Machine: Apple

Price: $174 per grade level package

COMPUTER CURRICULUM CORPORATION

P.O. Box 10080, Palo Alto, CA 94303; (415) 494-8450

Programs: English as a second language, reading, math and language arts; grades K-12

Machine: a turnkey system on purchased or leased CCC-17 minicomputer.

Price: unavailable

COMPUTER INFORMATION EXCHANGE

P.O. Box 159, San Luis Rey, CA 92068; (714) 757-4849

Programs: reading comprehension, electronics, math, statistics, philosophy, health services, Spanish, English and shop; grades 3-8 with some high school application

Machines: TRS-80 (Models I and III)

Price: $9.90 per program

*(***Buys and distributes from Dorsett line)*

CONCEPT EDUCATIONAL SOFTWARE

P.O. Box 6184, Allentown, PA 18001; (215) 266-1679

Programs: 25 in speed reading, chemistry, physics, math, basic English, languages and typing; grades K-12

Machines: TRS-80 (Models I and III)

Price Range: $20-$30

*(***Will also develop programs on request)*

CONTROL DATA CORPORATION

8100 34th Ave. South, P.O. Box 0, Minneapolis, MN 55440; (612) 853-4541

Programs: economics, languages and various sciences; grades 3-8 with some high school application

Machines: Plato systems

Price: unavailable

CONVERGENT SYSTEMS, INC.

245 East 6th Street, St. Paul, MN 55101; (612) 221-0587

Programs: basic English grammar; reading level 6. Also, basic electronics coming soon.

Machine: Apple II

Price: English grammar package is $345 for nine diskettes

COURSEWARE MAGAZINE

4919 North Millbrook #222, Fresno, CA 93726

Programs: five-times-a-year magazine, offering programs in math, business, English, science, etc.

Machines: Apple, Commodore PET, TRS-80

Price: $12.95 per issue

CREATIVE COMPUTING ("SENSATIONAL SOFTWARE")

39 East Hanover Ave., Plains, NJ 07950; (800) 631-8112

Programs: 47 choices in math, language arts, science, and social studies; grades 8-9. Also, simulations ("Trucker" and "Streets of the City"); some teacher utility programs and the Minnesota Education Computer Consortium and Huntington Computer Project lines

Machines: TRS-80, Atari, and Apple

Price: $24.95 per program

CREATIVE PUBLICATIONS

P.O. Box 10328, Palo Alto, CA 94303; (415) 968-1101

Programs: math strategies (linear search and grid search); grades 1-10

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Machines: Apple, TRS-80, and Commodore PET
Price: $23.95 per program

CROSS EDUCATIONAL SOFTWARE
P.O. Box 1536, Ruston, LA 71270; (318) 255-8921
Programs: four packages, including physics; "Happy Face" (vocabulary, spelling, riddles, and famous sayings); "Aquarium"; and a text editor; grades K-12
Machine: Apple II
Price Range: $10-$200

CYBERNETIC INFORMATION SYSTEMS
Box 9032, Upper Union St., Schenectady, NY 12309; (518) 393-0950
Programs: language skills, social sciences, and math; grades 7-12
Machines: TRS-80 (Models I and III)
Price Range: $7.95-$14.95

CYBERTRONICS, INC.
903 Park Ave., New York, NY 10021; (212) 772-9565
Programs: "Karel the Robot," introductory language to prepare for Pascal
Machines: Apples with Pascal
Price: $120

D

DATA COMMAND
P.O. Box 548, Kankakee, IL 60901; (815) 933-7735
Programs: reading skills, English and educational games; grades 4-8
Machines: Apple II and TRS-80
Price Range: $29.95 each; packages $113-$227.50

A. DOUGLAS DAVIS
1799 Meadowlake Drive, Charleston, IL 61920; (217) 345-4753
Programs: early learning, grades K-1; high school physics
Machines: Atari
Price: $20-$40

DEVELOPMENTAL LEARNING MATERIALS (DLM)
One DLM Park, P.O. Box 4000, Allen, TX 75002; (800) 527-4747; in TX, (800) 442-4711
Programs: "Arcademics" math-oriented games; grades K-12
Machine: Apple II Plus
Price Range: $39 each (including flash cards)

DILITHIUM PRESS
30 NW 23rd Place, Beaverton, OR 97005; (503) 646-2713
Programs: various math skills; grades 6-12
Machines: Apple, Commodore PET, and TRS-80
Price Range: $29.95-$995

DISNEY ELECTRONICS
6153 Fairmount Ave., San Diego, CA 92120; (714) 281-0285
Programs: physics, language, social studies, math, spelling; grades 1-6
Machines: Atari and TRS-80 (Models I and III)
Price: $9.95 (An audio attachment is available for $29.95.)

DR. DALEY'S SOFTWARE
Water St., Darby, MI 59829; (406) 821-3924
Programs: math, spelling, social sciences, learning letters and a grade management program; grades preschool-12
Machines: Commodore PET, Apple II
Price Range: $59.95-$79.95

DORSETT EDUCATIONAL SYSTEMS, INC.
P.O. Box 1226, Norman, OK 73070; (405) 321-0000
Programs: "Talk 'n Teach," shop, math, reading; K-12
Machines: Atari 400 and 800
Price Range: around $79

D-SOFT
319 Clarendon Ave., Southport, NC 28461; (919) 457-5157
Programs: a drawing program, number conversions, and telling time; grades K-12
Machines: TRS-80 (Models I and III)
Price Range: $7.95-$9.95 on cassette, $5.00 additional for diskette

DYNACOMP, INC.
1427 Monroe Ave., Rochester, NY 14618; (716) 442-8960
Programs: counting, arithmetic, word recognition and the game "Hodge Podge"; grades K-4. A teacher's aid program is also available for Atari.
Machines: Commodore PET, TRS-80, Apple and Atari
Price Range: $14-$25

E

EDUCAITOR, INC.
38 Main Street, Hudson, MA 01749; (617) 562-6222
Programs: "AdvoCAIte" authoring system, and a systems analysis training program; grades 9-12
Machines: Apple II Plus, TI99/4A, coming on IBM Personal and Xerox 820
Price Range: $590-$1050

EDUCATIONAL ACTIVITIES, INC.
P.O. Box 392, Freeport, NY 11520; (516) 223-4666
Programs: reading, language arts, math, science, classroom management; grades K-12
Machines: TRS-80 (Models I and III), Commodore PET, Apple II Plus, and Atari
Price Range: $11.95-$245

EDUCATIONAL AUDIO VISUAL I
Pleasantville, NY 10570; (914) 769-6332
Programs: computer science, biology, math, chemistry, physics, language arts and moder languages; grades 7-12 with an emphasis on senior high school
Machines: Apple II, Commodore PET and TRS-80
Price Range: $15-$515 (for complete computer science series)

EDUCATIONAL COMPUTING SYSTEMS
106 Fairbanks Road, Oak Ridge, TN 37830 (615) 483-4915
Programs: "Omni-Test" authoring system data base management system for administrator
Machine: Apple II
Prices: $49 for Omni-test; $95 for administrator package

EDUCATIONAL COURSEWARE
10 Bay St., Dept. 66, Westport, CT 06880 (203) 227-1438
Programs: physics, astronomy, chemistry and biology; grades 7-12. Also a computer literacy series and authoring language.
Machine: Apple II (*PET coming*)
Price Range: $24-$32; sets are available for $140 and the computer literacy series is $250

EDUCATIONAL DEVELOPMENT CORP.
P.O. Box 45663, Tulsa, OK 74145; (622-4522
Programs: computer instruction for teacher training; a reading and math series which ties in to testing (including the Dallas, TX, math program); grades 1-8
Machines: TRS-80 and Apple
Price Range: $795 for computer instruction and $2,495 for the entire software system

EDUCATIONAL MATERIALS AND EQUIPMENT CO.
P.O. Box 17, Pelham, NY 10803; (914) 576-1121
Programs: 23 science programs, including physics, chemistry, biology, and environmental science; grades 7-12
Machines: Apple II Plus and TRS-80 (Models I and III)
Price Range: $28-$100

EDUCATIONAL PROGRAMS
P.O. Box 2345, West Lafayette, IN 47906; (317) 463-4778
Programs: two in the development of high-level reasoning; grades K-12
Machines: TRS-80 (Models I and III)
Price: $12.95 each

EDUCATIONAL SERVICES MANAGEMENT CORP.
P.O. Box 12599, Research Triangle Park, NC 27709; (919) 781-1500
Programs: administrative only, includi attendance, reporting, scheduling, test sco and curriculum management packages
Machines: Apple II Plus (available soon on

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TRS-80, Models II and III)
Price Range: $350-$2,000

EDUCATIONAL SOFTWARE AND MARKETING CO.

1035 Outer Park Drive, Suite 309, Springfield, IL 62704; (217) 787-4594

Programs: administrative only; basic package includes faculty and student record-keeping, scheduling; attendance package is optional

Machines: Apple II, TRS-80 (Model II), Zenith Z-89 and any CPM

Price Range: $1295; $1595 with attendance package

EDUCATIONAL SOFTWARE MIDWEST

414 Rosemere Lane, Maquoketa, IA 52060; (319) 652-2334

Programs: drill and practice authoring system and CMI testing

Machines: Apple II

Price Range: $45-$129

EDUCULTURE

Suite 150, 1 Dubuque Plaza, Dubuque, IA 52001; (800) 553-4858

Programs: five areas of high school curriculum with audio

Machine: Apple II

Price Range: $625 complete; $125 for each section; $125 for audio attachment

EDU-SOFT—STEKETEE EDUCATIONAL SOFTWARE

4639 Spruce St., Philadelphia, PA 19139; (215) 747-1284

Programs: basic arithmetic, math, physics, computer literacy, teacher aids and reading readiness; grades K-12

Machines: Apple II and TRS-80

Price Range: $14.95-$19.95

EDU-WARE SERVICES

22035 Burbank Boulevard, 223, Woodland Hills, CA 91367; (213) 706-0661

Programs: reading, spelling, mathematics, and games in adventure and strategy

Machines: Apple II and Atari (models 400 and 800)

Price Range: $20-$50

ELECTRONIC COURSEWARE SYSTEMS

P.O. Box 2374, Station A, Champaign, IL 61820; (217) 359-7099

Programs: language arts, math, and music; grades 5-12

Machines: Apple II and III

Price Range: $6-$200

ENCYCLOPEDIA BRITANNICA EDUCATIONAL CORPORATION

425 North Michigan Avenue, Chicago, IL 60611; (312) 321-7330

Programs: curriculum materials available 1982-1983 school year; grades 5-12

Machines: Apple II, Atari, Commodore PET, TRS-80 (Models II and III)

Price Range: Not yet determined

EVANS NEWTON INC.

7745 E. Redfield Road, Scottsdale, AZ 85260; (602) 998-2777

Programs: administrative only, including curriculum management, attendance, and IEP planning

Machines: Apple, Commodore PET, and TRS 80 (Models II and III); IEP not available on TRS-80

Price: $1,995 complete

EYE GATE MEDIA INC.

146-01 Archer Ave., Jamaica, NY 11435; (212) 291-9100

Programs: 44 in social studies, consumer education, career education, vocabulary, language arts and math; grades 7-12

Machine: Apple II

Price Range: $59.90-$239.60

FG

FIVES

P.O. Box 788, Lakewood, CA 90713; (213) 920-8012

Programs: a variety of astrology studies; grades 7-12

Machines: Apple II, Commodore PET, and TRS 80 (Models I and III)

Price: most for $12.95

SUSAN GRAHAM

244 E. Monroe, Franklin, IN 46131; (317) 736-9439

Programs: arithmetic drill and practice; grades 1-8

Machines: TRS-80 (Models I and III)

Price: $7.50

H

HARTLEY COURSEWARE, INC.

P.O. Box 431, Dimondale, MI 48821; (616) 942-8987

Programs: 47 in language arts, reading, mathematics, and social studies; grades K-10

Machine: Apple II Plus

Price Range: $26.95-$93.95

HAYDEN BOOK COMPANY INC.

50 Essex St., Rochelle Park, NJ 07662; (201) 843-0550

Programs: administrative packages, math (including engineering math), some music, and typing aids; grades K-12

Machines: Apple, TRS-80, PET

Price Range: $10.95-$39.95 for instructional software; up to $1,000 for administrative packages

HEATHKIT EDUCATIONAL SYSTEMS

Dept. 558-872, Benton Harbor, MI 49022; (616) 982-3206

Programs: ten choices in programming, business, chemistry, and vocabulary; grades 10-12. Also, administrative packages.

Machine: Heath Zenith Z90

Price Range: $29-$495

HEI, INC.

Box 500, Victoria, MN 55386; (612) 443-2500

Programs: three packages for administrative and teacher use, including test-scoring and attendance-keeping; grades 1-12

Machine: Apple II

Price Range: $95-$455

HIGH TECHNOLOGY SOFTWARE PRODUCTS, INC.

P.O. Box 14665, 8001 N. Classen Blvd., Oklahoma City, OK 73113; (405) 478-2105

Programs: four series of chemistry simulations; grades 9-12

Machines: Apple II and Atari 800

Price Range: $50-$100

HOLT, RINEHART & WINSTON PUBLISHERS

School Marketing Dept., 383 Madison Ave., New York, NY 10017; (212) 872-2000

Programs: an administrative package called "CLASS" (Computerized Learning And Scoring System) which works with company's basal text program; grades 1-8

Machines: Commodore PET, IBM, Apple II, and TRS-80 Model III

Price: $2,000 complete

HOUGHTON MIFFLIN CO.

One Beacon St., Boston, MA 02107; (617) 725-5000

Programs: math computation, problem solving, reading, language arts, and teacher skills; grades 1-8

Machine: Dolphin

Price: unavailable

I

IBM (SYSTEMS PRODUCTS DIVISION)

P.O. Box 1328, Boca Raton, FL 33432; (305) 998-6007

Programs: arithmetic games and a typing tutor; grades 3-12

Machine: IBM Personal Computer

Price Range: $25-$90

IDEATECH COMPANY

P.O. Box 62451, Sunnyvale, CA 94088; (408) 985-7591

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Programs: seven programs in math (grid), language and basic electricity; grades K-12 or remedial use on any level
Machine: Apple II
Price Range: $9.95-$29.95

INFORMATION UNLIMITED SOFTWARE, INC.
281 Arlington Ave., Berkeley, CA 94707; (415) 525-9452
Programs: "Tellstar" astronomy; grades 7-12
Machines: Apple computers
Price Range: $40-$80

INSTANT SOFTWARE
80 Pine St., Peterborough, NH 03458; (603) 924-7296
Programs: typing, geography, math, and spelling; grades 1-12
Machines: Apple II and TRS-80 (Models I and III)

INSTRUCTIONAL/COMMUNICATIONS TECHNOLOGY INC. (I/CT)
10 Stepar Pl., Huntington Station, NY 11746; (516) 549-3000
Programs: a variety to increase comprehension power in language arts and reading (w/high interest and low readability levels); grades 4-9 (grades 10-12 available in Fall '82)
Machine: Apple II Plus
Price: $150 per level

INSTRUCTIONAL DEVELOPMENT SYSTEMS
2929 Virginia Beach, VA 23452, (804) 340-1977
Programs: Authoring system
Machines: Apple II and Apple II Plus
Price: $345; lease for $195/year

INTERACTIVE EDUCATION
Department 16D, 2306 Winters Drive, Kalamazoo, MI 49002; (616) 345-2911
Programs: eight in special education (focus on basic living skills); grades 6-12
Machine: Apple II
Price Range: $165-$340

INTERPRETIVE EDUCATION, INC.
Suite 250, 157 S. Kalamazoo Mall, Kalamazoo, MI 49007; (616) 345-8681
Programs: problem solving, money management, home safety, secondary special education; grades 7-12
Machine: Apple II
Price Range: $165-$340

J

JEM RESEARCH
Discovery Park, P.O. Box 1700, University of Victoria, Victoria, B.C., Canada V8W 2Y2; (604) 477-7246
Programs: administrator package and science kit (temperature gauge); grades 7-12
Machines: Apple II Plus
Price Range: Science kit is $200; administrator pack is $200 for one school, $500 for district wide version

J.L. HAMMETT COMPANY INC.
Hammett Place, P.O. Box 545, Braintree, MA 02184; (617) 848-1000
Programs: 200 choices in computer literacy, language arts, foreign languages, math, science, social studies, and special education; grades K-12
Machines: Apple, Commodore PET, and TRS-80 (Models I and III)
Price Range: $25-$200

J & S SOFTWARE
140 Reid Ave., Port Washington, NY 11050; (516) 944-9304
Programs: chemistry, biology, physics, vocabulary "baseball" and the Apple Grade Book; grades 7-12
Machines: TRS-80 (Models I and III) and Apple II
Price Range: $28-$250
*(***chemistry on TRS-80 only)*

K

KRELL SOFTWARE
21 Millbrook Drive, Stony Brook, NY 11790; (516) 751-5139
Programs: college board preparation, math and math adventure games, English, "Fig Newton" and "Isaac Newton" (pattern recognition); also, MIT LOGO for the Apple; grades 1-12
Machines: Apple, Commodore, and TRS-80 machines.
Price Range: $49-$2,495 for multi-program package

K-12 MICROMEDIA
P.O. Box 17, Valley Cottage, NY 10989; (201) 391-7555
Programs: math, language arts, reading, vocabulary, business, computer literacy, learning games and administrative programs; grades K-12
Machines: Apple, Commodore PET and TRS-80
Price Range: $7-$500

L

LANDMARK DATA SYSTEMS INC.
17 E. Church St., Martinsville, VA 24112; (703) 638-7611
Programs: attendance package
Machines: TRS-80 (Models I and III)
Price: $100

LEARNING TOOLS INC.
686 Massachusetts Ave., Cambridge, MA 02139; (617) 864-8086
Programs: all administrative-curriculum management, teacher planning, administrative planning, and the "Super Planner"; grades 1-12. Especially valuable for those working with the handicapped.
Machines: Apple II and III, IBM, Xerox 820, TRS-80 Model II and the North Star
Price Range: $200-$700

LEHMAN, JOSEPH JR.
Holiday Manor RD2, Box 56, Hollidaysburg, PA 16648; (814) 695-1547
Programs: ten choices in science, metrics, learning games and SAT vocabulary problems; grades 6-12
Machines: TRS-80 (Models I and III)
Price Range: $12-$42

LIFE SCIENCE ASSOCIATES
1 Fenimore Road, Bayport, NY 11705; (516) 472-2111
Programs: a variety of biology simulations; grades 11-12
Machines: TRS-80 (Models I and III)
Price Range: $20-$200

LIFE SOFTWARE LTD.
946 Van Horne Ave., Willowdale, Ontario M2J 2T1; (416) 491-2230
Programs: micro-math, vocabulary, spelling "demons" and a variety of hangman programs in different subjects; grades 1-12
Machines: Commodore PET and Apple II (for spelling only)
Price Range: $10-$100
*(***programs developed by Sheraton College; special prices available for school systems)*

LIKE TO LEARN CO.
P.O. Box 1904, Sherman, TX 75090; (214) 893-6007
Programs: 17 drill, practice and diagnostic testing in math, language arts and science; grades 3-8
Machines: TRS-80 (Models I and III)
Price Range: $14.50-$20

LOGO COMPUTER SYSTEMS
368 Congress St., Boston, MA 02210; (617) 451-2646
Program: Apple LOGO; grades K-12
Machine: Apple II Plus
Price: $175 for the package

M

MACROTONICS INC.
1125 N. Golden State Blvd., Turlock, CA 95380; (209) 667-2888
Programs: a Morse code tutorial, ham interface and text graphics printer; grades 3-12
Machines: TRS-80, Apple and Atari
Price Range: $29.95-$500

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MADISON COMPUTER
1825 Monroe Street, Madison, WI 53711; (608) 255-5552

Programs: video adapter, enables single computer to run two video monitors

Machine: Commodore PET

Price Range: $15-$65

MALIBU MICROCOMPUTING
23910A De Ville Way, Malibu, CA 90265; (213) 456-1137

Programs: by September, foreign language programs in "Adventure" game format

Machine: Apple II Plus

Price Range: probably $30-$50

MATHWARE/MATH CITY
4040 Palos Verdes Drive North, Suite 202, Rolling Hills Estates, CA 90274; (213) 541-3377

Programs: "Math System Five," a five curriculum program package; includes class management, diagnostic testing and data storage disks; grades 2-8

Machine: Apple II

Price: $350

MCGRAW HILL
1221 Avenue of the Americas, New York, NY, 10020; (800) 223-4180

Programs: Introduction to Microcomputers (computer literacy) and math drills, grades 4-6; also, the "Search" series, five science and social studies simulations aimed at group participation

Machines: All available for TRS-80 (Model III) and Apple II Plus; Introduction also for Commodore PET

Price Range: $38.25-$58.95; Search simulations are $180 each, including teacher binder and 20 student workbooks

M.D. FULLMER & ASSOCIATES
1132 Via Jose, San Jose CA 95120
(408) 997-1154

Programs: general question and answer game, alphabetizing, typing, division, and graph plotter; grades 1-12

Machines: Apple II

Price Range: $35-$50

MED SYSTEMS SOFTWARE
P.O. Box 2674, Chapel Hill, NC 27514; (919) 912-7949

Programs: three choices in mathematics, "Human Adventure" (travel inside the body) and the "Money Master"; grades 1-12

Machines: TRS-80 (Models I and III)

Price Range: $14.95-$17.95

MERLAN SCIENTIFIC LIMITED
247 Armstrong Avenue, Unit 8, Georgetown Ontario, Canada L7G4X6 (416) 846-0646

Programs: science and math; grades 8-12; also, administrative programs

Machines: Commodore PET

Price Range: $20-$180

MERRY BEE COMMUNICATIONS
815 Crest Drive, Omaha, NE 68046
(402) 592-3479

Programs: language arts and music; grades K-9

Machines: Apple

Price Range: $19.95-$29.95

MICRO ARCHITECT INC.
96 Dothan St., Arlington, MA 02174; (617) 643-1713

Programs: data base management and word processing; grades 10-12

Machines: TRS-80 (Models I and III), Zenith, IBM and others with CPM capabilities

Price Range: $69-$399

MICROCOMPUTER CORPORATION
34 Maple Avenue, Box B, Armonk, NY 10540; (914) 273-6480

Programs: more than 50 programs in basic learning—letter-recognition, arithmetic, vowels and consonants; grades K-5. Also, other programs in music, foreign languages, and a text-processor for administrative use

Machine: Texas Instruments 99/4A

Price Range: $9.95/cassette, $14.95/diskette

MICROCOMPUTER SOFTWARE SYSTEMS
4716 Lakewood Drive, Metaire, LA 70002; (504) 887-8572

MICROCOMPUTER WORKSHOPS
103 Puritan Dr., Port Chester, NY; (914) 937-5440

Programs: basic math, spelling, simple science, and lessons in graphing and genetics; also, preparatory programs for English achievement tests; grades 3-12

Machines: all for Commodore PET; math is available for Apple and TRS-80 (Models I and III) also

Price Range: most are $20/cassette, $24.95/diskette

*(***English achievement programs available soon for Apple)*

MICROCOMPUTERS IN EDUCATION
4148 Winnetka Ave. North, Minneapolis, MN 55427; (612) 533-2781

MICRO-ED INC.
P.O. Box 24156, Minneapolis, MN 55424; (612) 926-2292

Programs: math, punctuation, grammar, reading, social studies and spelling; grades K-12

Machines: most for the Commodore PET; some available for the VIC-20, Apple, TRS-80, and Texas Instruments 99/4A

Price: most for $7.95—series prices available

MICRO FOCUS
1601 Civic Center Drive, Santa Clare, CA 95050; (408) 496-0176

Program: COBOL computer programming

Machine: Apple II

Price: starts at $800

MICROGNOME
5843 Montgomery Road, Elkridge MD 21227; (301) 796-4165

Programs: CAI authoring systems

Machines: TRS-80 (Models I and III); CPM version will be ready by June.

Price Range: five versions, ranging from $42.95 to $395

MICRO LAB INC.
2310 Skokie Valley Road, Highland Park, IL 60035; (312) 433-7550

Programs: an English SAT tutorial, the U.S. Constitution, painting power (graphic arts) and an authoring/testing system; grades 7-12

Machines: Apple II

Price Range: $30-$150

MICRO LEARNINGWARE
P.O. Box 2134, North Mankato, MN 56001; (507) 625-2205

Programs: math, history, geography, German, accounting, economics, various sciences and administrative packages; grades 1-12

Machines: Commodore PET, TRS 80 (Models I and III), Apple II and the Radio Shack Color Computer

Price: most for $24.95

MICROMATICS
29 E. 1800 So., Bountiful, UT 84010; (801) 292-6574

Programs: phonics series, written originally for handicapped students but suitable for all schoolchildren, grades K-6

Machines: TRS-80 (Models I and III) and Apple II Plus

Price: $20 cassette, $40/disk

MICRO MUSIC INC.
309 West Beaufort, Normal, IL 61761; (309) 452-6991

Programs: 29 choices in ear training, orchestration, rhythm patterns, chord progressions and "a music-lover's grade system"; grades 1-12

Machines: Apple II or Apple II Plus

Price Range: $45-$500

*(***must have Micro Music accessories for all programs)*

MICRO POWER AND LIGHT
12820 Hillcrest Road #224, Dallas, TX 75230; (214) 239-6620

Programs: a variety of choices in math, language arts, science and "skills and tools"; grades 4-12

Machines: Apple

Price Range: $19.95-$39.95

MICROPHYS PROGRAMS
2048 Ford St., Brooklyn, NY 11229; (212) 646-0140

Programs: 180 choices in physics, chemistry, math, calculus, and English vocabulary and spelling; grades 7-12. Also, an administrator pack that handles attendance records and scheduling (on PET only)

Machines: Commodore PET, Apple II and TRS-80 (Models I and III)

Price Range: $20/cassette or $180/disk (about 15 programs)

MICROPI
Box 5524, Bellingham, WA 98227; (206) 733-9265

Programs: Pilot; English grammar, chemistry and scientific notation; grades 8-12

Machines: TI99/4A, Apple, Radio Shack

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Color Computer, Monroe, CPM
Price Range: $75-$150

MICRO SCHOOL PROGRAMS

c/o Bertamak Inc., 101 Nickerson, Suite 550,
Seattle, WA 98109; (206) 282-6249

Programs: comprehensive math package, math games, spelling, punctuation, problem solving, all for grades 1-8; special package for pre-schoolers; teacher's management system, reading level analyst, and grade keeper; administrative software includes attendance keeper and career information system

Machines: all available for TRS-80 (Models I, II, III); some available for Apple and Atari computers

Price Range: instructional software from $14.95 to $50; administrative ranges to $995

MICROSOFT CONSUMER PRODUCTS

10700 Northrup Way, Bellevue, WA 98004; (206) 828-8080

Programs: typing tutor, math skills and computer languages; grades 7-12

Machines: TRS-80 (Model I), Apple II or III

Price Range: $24.95-$750 (for computer language series)

MICRO SYSTEMS FOR EDUCATORS

P.O. Box 1981; Burlington, NC 27615; (919) 226-7610

Programs: management package for report-writing within the area of special education

Machines: TRS-80 (Models II and III), Apple II Plus and IBM Personal Computer

Price Range: $500-$650

MILLIKEN PUBLISHING

Computer Dept., 1100 Research Blvd., St. Louis, MO 63132; (314) 991-4220

Programs: 71 available in math, language arts, reading comprehension, grammar, and writing skills; grades 1-12

Machines: all for Apple II Plus, some for Commodore PET and TRS-80. *(K-8 Math Sequence available for Atari, Texas Instruments micros by September)*

Price Range: basic price $40/disk; less for multi-disk series.

MILTON BRADLEY CO.

Shaker Road, E. Longmeadow, MA 01028; (413) 525-6411

Programs: seven choices in math and language skills; grades 6-8

Machine: Apple II

Price: $44.95 per program

MINNESOTA EDUCATIONAL COMPUTING CONSORTIUM (MECC)

2520 Broadway Drive, St. Paul MN 55113; (612) 376-1118

Programs: science, math, business, music theory, social studies, English, drivers' education, industrial skills, programs for handicapped students, a new user's guide and applications for administrators; grades K-12

Machine: Apple II

Price: each $30; accompanying books for $1.70-$11

*(***Some programs available soon on Atari micros)*

MONROE EDUCATION CENTER

c/o Monroe Systems for Business
The American Road, Morris Plains, NJ 07950; (201) 326-9225

Programs: business education, math, science, language arts; grades 7-12

Machines: Monroe Computers

Price Range: $95-$500

MONUMENT COMPUTER SERVICE

Village Data Center, P.O. Box 603, Joshua Tree, CA 92252; (800) 854-0561 (in CA, 800/432-7257)

Programs: several administrative packages, including "Assistant Principal," which handles attendance, record-keeping, schedules and grade-reporting; also spelling and math (grades 1-8) and an authoring system

Machine: Apple II Plus

Price Range: $29.95 to $500 for administrator packs

MORGAN FAIRCHILD GROUP

P.O. Box 5457, Seattle, WA 98105; (206) 632-1374

Programs: a cartography system; senior high school

Machine: Apple II

Price Range: $350-$650

MSSS D INC.

3412 Binkley, Dallas, TX 75202; (214) 522-8051

Programs: interface with filmstrip: "Create-a-Lesson" authoring system; and software designed to complement various filmstrip presentations

Machine: Apple II Plus

Price Range: $200 for interface; $150 for authoring; $75 for others

MUSE SOFTWARE

330 N. Charles St., Baltimore MD 21201; (301) 659-7212

Programs: math lessons (with speech), authoring, 3-Mile Island (available till June '82), "The Voice" (a verbal enhancement for a variety of programs), "Robot War" (a programming teacher), word processing and statistical plotting; grades K-12

Machine: Apple II Plus

Price Range: $39.95-$175

N

NTS SOFTWARE

680 N. Arrowhead Ave., Rialto, CA 92367; (714) 875-2968

Programs: math, language and reading skills; grades K-9

Machines: TRS-80 (Models I and III)

Price Range: $15-$1000

O

OPPORTUNITIES FOR LEARNING, INC.

8950 Lurline Ave., Dept. L5, Chatsworth, CA 91311; (213) 341-2535

Programs: math, science, language arts, computer literacy, simulations, and games, also, some administrative and business ed. software; grades K-12

Machines: Apple, TRS-80, PET, and Atari

Price Range: $15-$400

P.Q

PERSONAL SOFTWARE, INC. (VISICORP)

592 Weddell Dr., Sunnyvale, CA 95086; (408) 946-9000

Programs: all administrative: VisiCalc, an electronic "worksheet"; VisiPlot, a graph making tool; VisiFile, an electronic filing system; and VisiTerm, which enables an Apple II to access mainframe computers

Machines: for VisiCalc—all Apple computers; Commodore PET, CBM and 8032; Atari 800; and IBM Personal Computer. (Also, TRS-80 and Hewlett-Packard versions available from their manufacturers.) Other programs — Apple II and II Plus only

Price Range: $200-$250

JOSEPH PETERSON

1109 Independence Drive, Westchester, PA 19380; (215) 388-6306

Program: "word search"—a crossword puzzle; grades 1-10

Machines: TRS-80 (Models I and III)

Price: $15

PHOENIX SOFTWARE

64 Lake Zurich Drive, Lake Zurich, Il 60047; (312) 438-4850

Programs: "Zoom" graphics interface for 20 different printers; adventure game (reading comprehension) for grades 5-8; in July, "The Effective Educator," self-profiling tool

Machine: Apple II Plus

Price Range: $22 up to $275 for "Effective Educator"

POWERSOFT

P.O. Box 157, Pitman, NJ 08701; (609) 58[illegible]00

Programs: foreign language drills, function graphing; word games, automotive diagnosis; grades 4-12

Machines: Apple II, Apple II Plus

Price Range: $14.95-$34.95

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PRESCRIPTION LEARNING

5240 S. Sixth Street Road, Springfield, IL 62707; (217) 786-2500

Programs: reading, math, language arts, spelling and some adult education; grades K-12

Machine: Commodore PET

Price Range: $50-$60

PROGRAM DESIGN INC.

71 Idar Court, Greenwich, CT 06830; (203) 661-8799

Programs: 35 choices in math, language arts and programming; also, an SAT preparatory program; grades pre-K-12

Machines: Atari, Apple II, TRS-80 (Models I and III), PET, and some on TI99/4A

Price Range: $16.95-$79.95

PROGRAMS FOR LEARNING, INC.

P.O. Box 954, New Milford, CT 06776; (203) 355-3452

Programs: six chemistry packages (60 programs), high school

Machines: TRS-80, Commodore PET and Apple

Price: most are $150

THE PSYCHOLOGICAL CORP.

757 Third Ave., New York, NY 10017 (212) 888-3500

Programs: the "Prism"—includes *Rekord* (data base management), math and reading; grades 1-12

Machines: Apple and TRS-80 (Model III)

Price Range: $250-$495

QUALITY EDUCATION DESIGN

P.O. Box 12486, Portland, OR 97212; (503) 287-8137

Programs: "ArithMagic," factoring whole numbers, fractions and decimals; grades 2-8

Machines: TRS-80 (Models I and III), Apple II and Apple II Plus, and PET

Price Range: $35-$175

RADIO SHACK EDUCATION DIVISION

400 Tandy Atrium, Fort Worth, TX 76102; (817) 390-3832

Programs: 30 choices in math, reading (including High Motivation series), language arts, mini-authoring, and the history of technology; grades K-12

Machines: TRS-80 (Models I and III) and the Radio Shack Color Computer

Price Range: $40-$500

RAMWARE

6 South St., Milford, NH 03055; (800) 258-1790

Programs: nine games, a typing tutor and basic statistics; grades—preschool for the games, high school for the statistics and those with previous skills for the typing tutor

Machines: TRS-80 (Models I and III)

Price Range: $9.95-$19.95

RANDOM HOUSE—HIGH SCHOOL DIVISION

2970 Brandywine Road, Suite 201, Atlanta, GA 30341; (404) 455-8570

Programs: reading, language arts, math and various management and support tools; grades K-12

Machines: TRS-80 and Apple II

Price Range: $24-$34.50 (for skills) and $699-$750 (for administrative programs)

READERS DIGEST SERVICES

Educational Division
Pleasantville, NY 10570; (914) 769-7000

Programs: math; grades 1-7

Machines: Apple II

Price: $129.90 per grade; $876 total

RESTON PUBLISHING CO., INC.

11480 Sunset Hills Rd., Reston, VA 22090; (703) 437-8900

Programs: "Multiploy," an arcade-style math game, and PAINT, graphics program that uses the cursor as a paintbrush; grades K-12

Machines: Math on Apple II; PAINT on Atari 800

Price Range: $19.95-$39.95

SANTA CRUZ EDUCATIONAL SOFTWARE

5425 Jigger Drive, Soquel, CA 95073; (408) 476-4901

Programs: intermediate and advanced instruction in BASIC programming; grades 7-12

Machines: Atari

Price Range: $19.95-$29.95; series of 6 for $99.95

SCIENCE SOFTWARE SYSTEMS, INC.

11899 West Pico Blvd., West Los Angeles, CA 90064; (213) 477-8541

Programs: all in the sciences, particularly physics and chemistry; grades 9-12

Machine: Apple II and Apple II Plus

Price Range: $50-$100

(***Company offers large A-V line*)

SCOTT FORESMAN & CO.

1900 East Lake Ave., Glenview IL 60025; (312) 729-3000

Programs: Two Reading and Math Series, including tutorial, remediation, music, and speech; grades K-8. Also, administrative packages and a course manager for Scott Foresman's basal math series

Machine: TI99/4A; manager also available on Apple.

Price Range: $39-$89; $200-$450 for administrative software.

SCWriP

Stephen Marcus, c/o Department of English, University of California at Santa Barbara, Santa Barbara, CA 95073; (805) 961-4422

Programs: "Compupoem," interactive poetry program; grades 4-12

Machines: Apple II and TRS-80

Price: $15.95

SubLOGIC COMMUNICATIONS CORPORATION

713 Edgebrook Drive, Champaign, IL 61820; (217) 359-8482

Programs: Spelling word lists; grades 1-12

Machines: Apple II

Price: $34.95

SEMI—SENTIENT SOFTWARE

P.O. Box 683, New York, NY 10001; (212) 858-3400

Programs: one to turn the computer into a multi-function calculator with 14-digit accuracy. Also, "Salvo Battleship"—a coordinate-oriented game; grades 1-12

Machines: TRS-80 (Models I and III)

Price Range: $15.98-$29.95

SERENDIPITY SYSTEMS, INC.

419 West Seneca St., Ithaca, NY 14850; (607) 277-4889

Programs: a teacher gradebook, advanced math (statistical analysis) and business; grades 10-12

Machine: Apple

Price: $169 each

SOCIETY FOR VISUAL EDUCATION

Dept. GF-2, 1345 Diversey Parkway, Chicago, IL 60614; (312) 525-1500

Programs: computer literacy, business, consumer education, math, science, social studies, reading and some programs in Spanish; grades K-12

Machines: Apple and TRS-80

Price Range: $25-$280

SOFTAPE

10756 Vanowen, North Hollywood, CA 91605; (213) 985-5763

Programs: the "magic window" word processor (with spelling correction); also the "Apple Talker" and "Apple Listener"; grades 2-12

Machine: Apple II

Price Range: $29.95-$99.95

SRA (SCIENCE RESEARCH ASSOCIATES INC.)

155 North Wacker Dr., Chicago, IL 60606; (312) 984-2053

Programs: math, language arts, computer literacy and classroom management; grades 1-12

Machines: Apple, TRS-80, IBM, Atari and Texas Instruments computers

Price Range: $60-$525

STARWARE

Dept. P2, 3901 Davis Place N.W., Washington, D.C. 20007; (202) 337-5300

Programs: "gradem" classroom management, math skills and programs to improve reading and speaking skills (focus on speed and comprehension in reading); grades 1-12

Machine: IBM Personal Computer

Price Range: $29-$149

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STERLING SWIFT PUBLISHING CO.
1600 Fortview Road, Austin, TX 78704; (512) 444-7570

Programs: a variety on programming, math skills and an elementary mathematics learning system; grades 3-12

Machines: Apple, TRS-80 and Commodore PET

Price Range: $69 each, $195 for the learning system, which comes in English or Spanish on the Apple computer only

STRATEGICS SIMULATIONS
465 Fairchild Dr., Suite 108, Mountain View, CA 94043

Programs: two choices in business management and political science; grades 9-12

Machines: Apple II or Apple II Plus

Price: $39.95 each

STONEWARE
1930 Fourth St., San Rafael, CA 94901; (415) 454-6500

Programs: two statistics packages and a graphics processor; grades 10-12

Machines: Apple

Price Range: $59.95-$100

SUNBURST COMMUNICATIONS
39 Washington Ave., Pleasantville, NY 14850; (800) 431-1934

Programs: language arts, social studies, math, computer literacy and reading; grades 3-8

Machines: Apple, TRS-80 and Commodore PET

Price Range: $15-$90

SYNERGISTIC SOFTWARE
5221 120th Ave., S.E., Bellevue, WA 98006; (206) 226-3216

Programs: four choices in astronomy, linguistics and communications; grades 1-2

Machine: Apple

Price Range: $30-$40

T

TEACH YOURSELF BY COMPUTER SOFTWARE (TYC)
40 Stuyvesant Manor, Geneseo NY 14454
(716) 243-3005

Programs: 50 programs in foreign languages, grammar, math, history, biology, spelling, earth science, memory and study skills, and classroom management; grades 1-12

Machines: Apple, TRS-80

Price Range: $13-$78

TEACHER'S PET
P.O. Box 50065, Palo Alto, CA 94303; (415) 526-8069

Programs: math drills, language arts, reading comprehension, and logic games using math skills; grades 4-8

Machine: Commodore PET

Price Range: $7.95/cassette, $50/diskette (includes several math or reading programs)

THE TEACHING ASSISTANT
22 Seward Drive, Huntington Station, NY 11746; (516) 499-8397

Programs: physics, grade management and word recognition; grades 7-12

Machines: TRS-80 (Models I and III)

Price Range: $12.50-$24.95 or $55 per package

TEACHING TOOLS: MICROCOMPUTER SERVICES
P.O. Box 50065, Palo Alto CA 94303
(415) 493-3477

Programs: Math drill, beginning language arts, spelling (with interface for recorder), and match games; grades K-6

Machines: Apple, Commodore PET, and TRS-80 Model III

Price Range: $20 up to $139 for spelling program with interface

TECK ASSOCIATES
P.O. Box 8732, White Bear Lake, MN 55110; (612) 739-4939

Programs: authoring, typing, art education, math drills, learning games and programs for curriculum management; games pre-K—12

Machine: Apple II

Price Range: $19.95-$34.95

*(***demo of program selections available for $5)*

TERRAPIN INC.
678 Massachusetts Avenue, #205 Boston, MA 02139; (617) 492-8816

Programs: Terrapin LOGO

Machines: Apple II

Price: $149.95

TEXAS INSTRUMENTS
P.O. Box 53, Lubbock, TX 79408; (800) 858-4565

Programs: LOGO, arithmetic, music, BASIC tutorial, beginning grammar and spelling; administrative package; also, new "Speak 'n Math" and "Speak 'n Spell" programs with audio; most are grades pre-K—8

Machine: Texas Instruments 99/4A

Price Range: $20-$40; LOGO is $129.95

THESIS (T.H.E.S.I.S.)
P.O. Box 147, Garden City, MI 48135; (313) 595-4722

Programs: 14 available in language arts and math; grades pre-K—8

Machines: Atari and Apple II

Price Range: $15-$25

TIME SHARE CORP.
Mount Support Road, Hanover, NH 03755; (603) 448-3838

Programs: a guidance information system with data on occupations, the armed forces, financial aid, colleges and graduate schools; high school application

Machine: Dolphin

Price: unavailable

TYCOM ASSOCIATES
68 Velma Ave., Pittsfield, MA 01201; (413) 442-9771

Programs: math, English/vocabulary, languages and a variety of game programs; grades 7-12

Machine: Commodore PET

Price Range: $15.95-$29.95 *(additional modules for programs available for $20)*

TWO STAR SYSTEMS
Rm. 235, 10 Park Place, Morristown, NJ 07960; (201) 267-0737

Programs: "CLASS"—a curriculum management program with diagnostic and prescriptive testing; grades K-12

Machines: Commodore PET and Apple

Price: $1995

U-Z

UNICOM
297 Elmwood Avenue, Providence, RI 02907; (401) 467-5600

Programs: two administrative programs, involving inventory, circulation, grades, attendance, lists

Machines: Apple II

Price: $250 each

WISE OWL WORKSHOP
1168 Avenida de las Palmas, Livermore, CA 94550; (415) 443-5248

Programs: games using phonics, grades K-8

Machines: Apple II, TRS-80 (Models I and III)

Price Range: $24.50-$28.50

XPS INC.
323 York Road, Carlisle, PA 17013; (717) 243-5373

Programs: "Dean's List," a mini authoring system enabling user to create opposing files, and a diagnostic test for computer maintenance purposes

Machines: Apple II and II Plus

Price Range: $24.95 for "List"; $19.95 for diagnostic program

XTRASOFT
P.O. Box 91063, Louisville, KY 40291; (502) 499-1533

Programs: touch typing, U.S. Presidents, vocabulary builder and the periodic table; grades 6-12

Machine: Zenith

Price: $25.95 each

ZWEIG ASSOCIATES
1711 McGaw Avenue, Irvine, CA 92714; (714) 549-3246

Programs: reading and math testing; grades 1-6

Machines: Apple II, Commodore PET, TRS-80 (Model III)

Price: $25 each

EL

TERC Technical
Education
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8 Eliot Street, Cambridge, Massachusetts 02138 Telephone 617-547-3890

MICROCOMPUTERS IN EDUCATION: AN INTRODUCTION

by Adeline Naiman, Managing Director, TERC

TERC announces the publication of a new book commissioned by the Northeast Regional Exchange and published jointly with the Exchange (NEREX). Microcomputers in Education: An Introduction is directed at novices--teachers, administrators, school board members, parents, and interested citizens--who want to learn about the educational uses of microcomputers. The book sets out issues of concern, the kinds of equipment and teaching materials to choose among, and possible instructional applications. Completed in January 1982 with funding from the National Institute of Education, this book is a sequel to TERC's 1980 NREPP report and updates much of the information included in that study.

The contents of Microcomputers in Education: An Introduction are these:

- Background, including a brief history of the use of microcomputers.
- The need for planning--setting up a planning group, funding, pitfalls.
- A sampling of state policies, practices, and services.
- Applications and location of microcomputers in schools.
- What you need to know to get started--information sources, hardware, software/courseware, languages, a decision model for purchasing equipment.
- Teacher education--some inservice ideas.
- Assessing the success of your program.
- Summary conclusions.
- Appendices:
  - Equipment selection decision model.
  - References--periodicals, software reviews, bibliographies, books, associations.
  - Sample software evaluation forms.
  - Partial list of Northeast user groups.
  - Selected listing of software suppliers.
  - Survey of microcomputer use in New York's Capital districts.

Copies of the book may be ordered from TERC, 8 Eliot St., Cambridge, MA 02138. Each copy costs $5.00. Shipping charges are $2.00 additional, first class, per copy; $1.00 book rate; 10 or more copies shipped at cost.

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Instructor at Illinois State University.

WORD PROCESSORS
FOR APPLE MICROCOMPUTERS

Apple Pie + Formatter ($79.95)
Programma International Inc.
2908 North Naomi St.
Burbank, CA 91504
213-954-0240

Appen I Text Editor ($17.95)
(Tape only)
Muse Software
330 N. Charles St.
Baltimore, MD 21201
301-659-7212

Apple-Scribe 2 ($59.95)
Pygmy Programming
P.O. Box 3078
Scottsdale, AR 85257

Appletext ($33.95)
Microproducts
30420 Via Rivera
Ranchos Palos Verdes, CA 90274
213-541-5131

Apple Writer ($70.00 app.)
Apple Computer
10260 Bandley Dr.
Cupertino, CA 99501
408-966-1010

Apple Writer Extended ($34.95)
Brillig Systems Inc.
10270 Fern Pool Court
Burke, VA 22015

Datacope Scribe ($79.95)
Datacope
P.O. Drawer AA
Little Rock, AR 72205
501-664-2715

Dr. Memory ($49.95)
Muse Software
330 N. Charles St.
Baltimore, MD 21201
301-659-7212

Easymover (No price)
Information Unlimited Software
281 Arlington Ave.
Berkeley, CA 94707
415-525-9452

The Professional System Easywriter
($250.00)
Information Unlimited Software
(as above)

Programma Improved Editor ($24.95)
Programma International Inc.
(as in left column)

Form Letter ($24.95)
Micro Software Systems
7927 Jones Branch Dr.
McLean, VA 22102
703-821-1350

Form Ur Doc ($30.00)
Darrells Applesoft Inc.
17628 157th Ave. S.E.
Renton, WA 98055
206-226-1224

Format ($24.95)
Programma International Inc.
(as in left column)

Letter Perfect ($149.95)
High Technology
1611 Northwest 23rd St.
Oklahoma City, OK 73106
405-840-9900

Magic Window ($99.95)
Artsci Inc.
10432 Burbank Blvd.
North Hollywood, CA 91601
213-985-2922

Report Writer ($108.00)
Computer House Div.
1407 Clinton Rd.
Jackson, MI 44202
517-782-2132

WORD PROCESSORS FOR APPLE MICROCOMPUTERS

Supertext II ($150.00)
Muse Software
(see other page)

Supertext Add On Modules
Form Letter ($100.00)
Address Book Mailing List ($49.95)
Supertext Terminal ($75.00)
Muse Software

TXT/ED 2.0 ($79.95)
Systems Design Lab
2612 Artesia Blvd. Suite B
Redondo Beach, CA 90278
213-374-4471

Text Editor ($64.95)
Micro Software Systems
(See other page)

Text File Editor ($24.95)
Edu-Ware
22035 Burbank Blvd.
Woodland Hills, CA 91367
213-346-6783

Text Power ($79.95)
Systems Design Lab
(See above)

Text Editor I ($14.95)
Dynacomp, Inc.
6 Rippingale Road Dept. C
Pittsford, NY 14534
716-586-7579

Word Power ($99.95)
Systems Design Lab
(See above)

Word Processor ($99.00)
Howard Software Services
7722 Hosford Ave.
Los Angeles, CA 90045

Word Processing ($300.00)
Computer House Inc.
(See other page)

Word Processing System ($79.95)
Programma International
(See other page)

Write On!! ($99.50)
Rainbow Computing
9719 Reseda Blvd.
Golden Plaza 1-A
Northridge, CA 91324
213-344-9556

Write On!! II ($150.00)
Rainbow Computing
(See above)

WORD PROCESSING

on

MICROCOMPUTERS

MORRIS W. FIREBAUGH
UW-PARKSIDE
KENOSHA,WI 53141

PRESENTED AT
WISC AAPT MEETING
MAY 8, 1982

WORD PROCESSING ON MICROCOMPUTERS

Morris W. Firebaugh
Department of Physics
UW-Parkside, Box 2000
Kenosha, WI 53141

I. BACKGROUND

After fairly extensive surveys of microcomputer hardware(1) and BASIC software systems(2), I decided to purchase an APPLE II microcomputer for my personal use in university and professional business. My expectation at the time of purchase was that the primary use of the system would be as an analytical tool for problem solving and data analysis. As frequently happens in many areas of research and in building computer systems specifically, the unexpected results often turn out to be more significant than the original objectives. In this particular case, the use of the microcomputer as a word processor has become the dominant one. Demand for the use of the microcomputer just within the family has grown to the point that we even have to schedule its use on occasion.

This personal experience closely parallels the historical path of the significant areas of computer development: first in data processing, then in word processing, next in image processing (graphics), and finally in voice processing. This is a natural evolution in the application of computers to more sophisticated data structures. An appreciation of this underlying structure helps in interpreting trends in research and development in computer science. It is also difficult to overemphasize the effect word processing will have on the structure and productivity of offices, the new freedom and productivity it offers individual professionals, and the impact it will have on the whole communications and publishing industry.

Since declining budgets on many campusses seriously threaten the service provided instructional faculty (already a ridiculous 1.5 secretaries for 50 instructors in our division), individual faculty members are finding word processors can provide extremely effective and convenient technique to break through these barriers by "doing it yourself". Since such prolific writers as Isaac Asimov testify as to the value of microcomputer-based word processors,(3) instructional faculty may wish to consider the opportunities word processors open up.

II. Applications in an Instructional Environment

A word processor is basically a text editor with the capability of entering, correcting, modifying, and manipulating text with a flexible and powerful system. The immediate and obvious advantage is that one need not be an expert typist, but rather can type for maximum speed since error correction is trivially easy. In addition, the manipulations possible with word processors makes the production of error free documents an order of magnitude easier. These characteristics are perfectly suited for many academic activities. Several immediately apparent applications include:

- Preparing course outlines and syllabi.
- Preparing laboratory outlines.
- Course handouts and materials.
- Preparing quizzes and exams.
- Routine departmental business - timetable, catalog copy, program reviews.
- Seminar and colloquia announcements.
- Correspondence of a routine and/or repetitive nature (personalized recruitment and student status letters).
- Research proposals and papers.

Most of these applications share certain characteristics, the most obvious of which is that new textual material is generally of the same format and often nearly identical with the previous material. For instance, the timetable will generally list the same courses with only minor modification of class times and instructor assignments required. Since one feature which all word processors share is the ability to store text files cheaply and in a form which is easily recalled (generally on "floppy disk"), word processors help organize an office and increase its efficiency. Therefore, to produce the new timetable, one simply loads the disk with last year's timetable, runs a listing, marks the listing by hand with the desired changes, and very rapidly edits in the changes and runs a final updated listing.

Similarly, the instructor can rapidly and easily modify laboratory outlines, deleting portions which were unsuccessful, adding new exercises, and modifying equipment descriptions and I.C. model numbers to keep the experiment modern and consistent with laboratory facilities. Thus, updating laboratory programs become simple editing exercises rather than a major effort in rewriting with the inevitable errors introduced by such an undertaking.

While microcomputer-based word processors lack some of the more elegant features available on larger dedicated departmental word processors (primarily Greek and mathematical symbols), powerful new typesetting systems are appearing for which the microcomputer word processor serves as editor and driver. Since

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these large systems include the finest typographic features available anywhere, the lowly microcomputer equipped instructor can become his/her own book publisher.

III. Case Study - MAGIC WINDOW on the APPLE II

HARDWARE

Based in the studies previously mentioned, it appeared that the APPLE II offered a good compromise between simplicity, cost, and expandability. The original system grew steadily over a period of two years and is described in Table I.

TABLE I

Hardware Configuration	Required for Word Processing
APPLE II+ with 48K memory	Yes
Language Card (16K memory with Pascal)	No
Novation APPLE-CAT Modem (communications)	No
MICROBUFFER II Printer driver (32K buffer)	No
Two 5 1/4" floppy-disk drives	1 req
Epson MX-80 printer with plotting package	Yes

The minimum configuration, but one completely adequate for doing the word processing described below, would consist of a 48k APPLE II+ with one floppy-disk drive and an MX-80 printer. By careful shopping this can be purchased for about $2250.

The two additional cards provide the following useful features: the modem allows the APPLE to talk with any other computer with dial-up ports. Thus I can run FORTRAN, WATFOR, and extended BASIC on the University's PDP-11/70 using the APPLE as a control terminal with memory. In addition, I can talk with the UW-Madison UNIVAC 1100 which has the elegant TEX and METAFONT typesetting system (4). Second, the MICROBUFFER card serves as an output buffer into which up to 1/2 of core memory (32K) may be dumped almost instantaneously and printed while control of the computer returns to the operator. Particularly in word processing with the need to list large alpha-numerical data files frequently, this is a great time-saver.

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SOFTWARE

The word processor which I have used for almost two years and which I describe in detail here is the **MAGIC WINDOW**. This program is essentially a "bottom of the line" program and is widely available for as little as $75. It was selected almost at random, being highly recommended and available at the local computer store. While some desirable features (discussed later) are missing, it is an extremely easy-to-learn, easy-to-use, and flexible system. We describe here some of the most important features of **MAGIC WINDOW** and present the details of the menu options and editing commands in APPENDIX A.

MAGIC WINDOW Features

* Screen format of text is essentially identical with printer format, i.e. "**what you see is what you get**" (the only exceptions are some imbedded printer controls).

* **TYPEWRITER Analog** - screen -->sheet, scrolling past, with cursor fixed in center of screen analogous to printer ball. Analog extends to simulated key "clicks" and changed pitch "bell" at end of line. This "window on a page" algorithm successfully overcomes the 40 column limit of the APPLE II.

* Totally **MENU DRIVEN Function Controls** The master menu includes the EDITOR, FORMAT, FILER, PRINTER, CONFIGURATION subsystems as well as EXIT TO BASIC. The operator drives the flashing cursor up or down the menu with the right and left arrows and selects the desired subsystem by hitting the "return" key.

* **LINE oriented editing** with very flexible "split and glue" option and word wrap (automatic CR).

* **FLEXIBLE CURSOR COMMANDS** with a natural "write over" feature.

* **LINE JUSTIFICATION**, including right, left, center, and expand.

* **AUTOMATIC PAGE LABELING AND NUMBERING**

* **STRING SEARCH**

* **Convenient FILE Handling**, with provision for file merging.

- **Several PRINT STYLES Available**, including

  DOUBLE WIDTH

  ITALICS MODE

  CONDENSED TYPE MODE

  NORMAL TYPE (appears light here - note dot-matrix)

  EMPHASIZED MODE (used for this paper)

  DOUBLE STRIKE MODE (used for emphasis in this paper)

  AND COMBINATIONS (like this)

My overall evaluation is that **MAGIC WINDOW** is a a very fine word processor with many of the features of dedicated word processing systems. As such it is a valuable addition to the program library of anyone with an APPLE microcomputer. It does, however, have its weaknesses and deficiencies.

FEATURES MISSING ON MAGIC WINDOW

Here is a list of features, in their order of importance, which I have suggested for improving **MAGIC WINDOW**.

- Extended alphabet with Greek and math symbols, or perhaps better, procedures for user defined symbols.

- Subscript, superscript, and underlining capability.

- The equivalent of "margin release" on a typewriter. Presently there is no overriding the (variable) margins.

- Proportional spacing of letters.

- Block moves to manipulate whole paragraphs or pages.

- Capability for 132 characters/line and possibly double column pages. present limit is 85 characters/line.

- Capability for "pause" for user inserted information.

- "Memory available" option to indicate bytes used and bytes available.

- 70 column display with upper/lower case. Presently all characters displayed are upper case with real capitals high-lighted, although the printer has upper/lower case.

- Capability for continuous back-up. This must be done manually at present.

- Capability for "SEARCH AND REPLACE" in addition to the present "SEARCH" option.

- Capability for multiple copies.

A personal communication with **ARTSCI**, the makers of **MAGIC WINDOW**, indicates that a new version to be released this month will include many of these missing features. The whole field of microcomputer software is the most dynamic and competitive possible, and products like word processors must continually evolve to include the desirable features of the competition or the product will die an early death. Within the last month, two of **MAGIC WINDOW**'s main competitors, **APPLE WRITER** and **SUPERSCRIBE II** (now known as **SCREENWRITER** II) have issued new releases which will upgrade already excellent products. This competition can only benefit the end user.

CHARACTERISTICS AND LIMITATIONS OF THE MX-80 PRINTER

Although the competition in high-quality, low-cost printers is extremely keen, the **EPSON MX-80** printer remains a very cost-effective printer for word processing applications. IBM selected the MX-80 as the standard printer for their Personal Computer. The features which make it so attractive include: high-resolution graphics capability, "true descenders" for lower case letters, and a variety of font types. One of these, used to produce this document, causes the dot print matrix to strike the paper twice, shifting about one dot width between strikes. This effectively eliminates the obvious dot matrix structure of the printed characters which many users find the most objectionable feature of dot-matrix printers.

One limitation of the MX-80 is that it uses only form-feed paper. This means that using single sheet stationary, for example, is awkward at best. Two tricks to get around this limitation are: a) make a closed-loop band of three sheets of form-feed paper and tape the single sheet stationary to the band, and b) type the letter on regular form-feed paper but in the format to fit the stationary letter head. Then make a transparency of the letter head stationary, place it over the MX-80 printed letter, and Xerox the combination. Only one transparency is required for each type of stationary, and the results are fairly good.

IV. OTHER MICROCOMPUTER BASED WORD PROCESSORS

The word processor described above was used as an example for two reasons: it is the system I accidentally acquired,and it illustrates the power of a very inexpensive word processor available for microcomputers. There are, of course, many other microcomputer-based word processors, many with powerful features missing from (the present) **MAGIC WINDOW**. These products fall generally into two categories, CP/M (Z-80) based and APPLE/ATARI (6502) based. In Table II we list the name and price for each of these systems from a recent review (5).

Table II

MICROCOMPUTER-BASED WORD PROCESSORS
by Category

CP/M (Z-80) Based		APPLE/ATARI (6502) Based	
Benchmark	$499	Apple Writer	$75
Magic Wand	$1395	Easy Writer	$100
Mince (Scribble)	$125	Letter Perfect	$150
Scripsit	$99/$399	Magic Window	$100
Select	$595	Superscribe II	$130
Spellbinder	$495	Super Text	$150
Vedit	$130	Wordstar (Z-80 card req)	$495
Wordstar	$445	PIE Writer (APPLE PIE)	$150
		Zardax	$295

Many of these systems have been reviewed elsewhere,(6-15) and and several have some exceptional features. **PIE Writer**, for instance, has proportional, incremental spacing for justifying text and automatic "search and replace". **Screenwriter II** has successfully overcome the limitations of the 40-column APPLE screen by providing a 70-column display with upper/lower case, simply by software design, and includes printer spooling which allows the user to print while editing. One cannot therefore recommend any one system to the exclusion of the rest. Each has features distinguishing it from the rest, and no one system has every desirable feature. If it did one could be sure that low price would not be among them.

Our conclusion is that the best word processor is one that works well for you. In general, the (SIMPLICITY)*(POWER) uncertainty principle applies to word processors just as it does to all computer systems. A truly powerful system must sacrifice something in simplicity and *vice versa*.

V. RELATED PROGRAMS

There are two other programs related to word processing which I have found very useful. They are **APPLE SPELLER** and **HIGHER TEXT.**

APPLE SPELLER is a spelling checker program with a built in dictionary of over 30,000 words and the capacity for adding up to 10,000 user-defined words (technical, personal, and jargon). This program will operate on the text files produced by essentially all of the major APPLE based word processors and, after finding all words not in its dictionary, gives the user three options:

1) Ignore (for special names, cities, rarely used).

2) Add to dictionary (correctly spelled words missing from present version of dictionary, like *PIUN*).

3) Mark in text for correction (flag true misspellings).

Not only is the program very well designed and very fast, but it also produces interesting statistics. A summary of the statistics on this paper is presented in Table III.

Table III

APPLE SPELLER STATISTICS
for this article

Total number of words	2991
Number of Unique Words	1029
Time for spelling analysis (sec) (measured by stopwatch)	
To read and sort text	55
To compare to dictionary	20

The second program related to text manipulation is HIGHER TEXT. This program uses the high resolution graphics feature of the APPLE to produce decorative fonts. These are particularly use- ful for creating title pages, labels, signs, and transparencies for classroom and professional presentations. Examples of some of the fonts available are shown in APPENDIX B.

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ADDENDUM A

SOME DETAILS OF MAGIC WINDOW OPERATION

I. SIGNING ON

1. Insert "**MAGIC WINDOW Word Processor**" disk in Drive 1 and hit "RETURN"

2. Remove "**MAGIC WINDOW**" from Drive 1

3. Insert your 16-sector data disk in Drive 1 and hit "ESC".

4. This brings you to the top of the "SUBSYSTEM MENU". Your options now are:

EDITOR SUBSYSTEM
FORMAT SUBSYSTEM
FILER SUBSYSTEM
PRINTER SUBSYSTEM
CONFIGURATION SUBSYSTEM
EXIT TO BASIC

You may select one of these options by moving up or down the list with the right and left arrows. To create a new file, hit the "RETURN" key to enter the (default) "EDITOR SUBSYSTEM".

5. After creating your document in the EDITOR, you return to the SUBSYSTEM MENU by simultaneously pressing the three keys

"CTRL" + "SHIFT" + "P" to escape

6. Generally, at this point, you want to either print your results or save them to disk file. To print, use menu selection to give:

PRINTER SUBSYSTEM
PRINT HARDCOPY
<now position top-of-paper to top-of-platten>
RETURN

7. Check your copy for accuracy and style. To make corrections reenter the EDITOR by way of the SUBSYSTEM MENU. When satisfied with copy, go to step 8.

8. Save your file using menu selection:

FILER SUBSYSTEM
SAVE FORMATTED FILE
Enter *FILE NAME* when requested

II. EDITING COMMANDS

(Note: commands with * require both "CTRL" + "SHIFT")

(Note: Single Capitals="ESC", CAPITAL LOCK="ESC"+"ESC")

<CTRL>
+

CHARACTER COMMANDS

D = delete a character at cursor
F = insert a space at cursor
B = enter a control character at cursor
V = copy character above cursor (i.e. "ditto")

CURSOR COMMANDS

Q = cursor up one line
W = cursor up 12 lines (1/2 screen)
E = cursor to top-of-file
Z = cursor down one line
X = cursor down 12 lines (1/2 screen)
C = cursor to bottom-of-file
A = tab left (backward to last tab stop)
S = tab right (forward to nest tab stop)
M = carriage return and line feed
N = cursor to next occurrence of string (use with "search")
P = cursor to top of page N (supply N when asked)
H = backspace (same as left arrow)
U = same as right arrow

LINE COMMANDS

K = kill line (delete and push on stack - recoverable by R)
O = clear line (push on stack but leave space)
R = recover line from stack (use K and R to move lines)
I = insert a blank line
L = clear to end of line
T = split line at cursor *(use "T, insert phrase, G" to*
G = glue lines together *perform major editing changes)*
J = justify line (right,left,center,expand,pack options)

OTHER COMMANDS

Y = assign page title
= assign search string
= clear all tabs
N* = set tab at cursor
M* = clear tab at cursor
P* = exit EDITOR, return to SUBSYSTEM MENU

III. SUBSYSTEM OPTION MENUS

```
+++++++++++++++++++++++++++++++++++

FORMAT SUBSYSTEM

     PAGE LENGTH...............66
     TOP MARGIN................6
     TEXT LENGTH...............54
     PAGE WIDTH................80
     LEFT MARGIN...............8
     TEXT WIDTH................64
     DOUBLE SPACE..............NO

     SUBSYSTEM MENU
     CHANGE FORMAT OPTIONS

+++++++++++++++++++++++++++++++++++


FILER SUBSYSTEM

     DISK SLOT.................6
     DISK DRIVE................1
     DISK VOLUME...............0

     SUBSYSTEM MENU
     CHANGE DISK OPTIONS
     FILES DIRECTORY
     SAVE FORMATTED FILE
     LOAD FORMATTED FILE
     UNFORMATTED LOAD/SAVE
     DELETE FILE
     CLEAR FILE IN MEMORY


+++++++++++++++++++++++++++++++++++

PRINTER SUBSYSTEM

     PRINT LOWER CASE..........YES
     PRINT ALL PAGES...........YES
     STARTING PAGE #...........1
     PAGE STOP.................NO
     MARK PERFORATION..........NO

     SUBSYSTEM MENU
     CHANGE PRINT OPTIONS
     PRINT HARDCOPY
     PRINT SOFTCOPY

+++++++++++++++++++++++++++++++++++
```

APPENDIX B

EXAMPLE FONTS FROM HIGHER TEXT

ROMAN:
0123456789
ABCDEFGHIJ
KLMNOPQRST
UVWXYZ#$%&

APPLE:
0123456789
ABCDEFGHIJ
KLMNOPQRST
UVWXYZ#$%&

BROADWAY:
0123456789
ABCDEFGHIJ
KLMNOPQRST
UVWXYZ#$%&

SHADED:
0123456789
ABCDEFGHIJ
KLMNOPQRST
UVWXYZ#$%&

QUOTE:
0123456789
ABCDEFGHIJ
KLMNOPQRST
UVWXYZ#$%&

SPACE:
0123456789
ABCDEFGHIJ
KLMNOPQRST
UVWXYZ#$%&

COUNTDOWN:
0123456789
ABCDEFGHIJ
KLMNOPQRST
UVWXYZ#$%&

SHADOW:
0123456789
ABCDEFGHIJ
KLMNOPQRST
UVWXYZ#$%&

NORMANDIA:
0123456789
ABCDEFGHIJ
KLMNOPQRST
UVWXYZ#$%&

BLOCK:
0123456789
ABCDEFGHIJ
KLMNOPQRST
UVWXYZ#$%&

celtic:
0123456789
abcdefghij
klmnopqrst
uvwxyz#$%&

GOTHIC:
0123456789
ABCDEFGHIJ
KLMNOPQRST
UVWXYZ#$%&

LIST OF PRESENTERS AND VENDORS

AGRICULTURE

W. Jerry Howard
University of Wisconsin-Extension
281 Animal Sciences
1675 Observatory Drive
Madison, WI 53706
(608)263-3495

Dale L. Diedrich
District One Technical Institute
620 W. Clairemont Avenue
Eau Claire, WI 54701
(715)836-3935

Harlan G. Hughes
University of Wyoming
Division of Ag Economics
Laramie, WY 82071
(307)766-2107

Andy Suess
CESA #6
725 W. Park Avenue
Chippewa Falls, WI 54729
(715)723-0341

- -

BUSINESS

Mel Hynek
Milwaukee Public Schools
5225 W. Vliet Street
Milwaukee, WI 53208
(414)475-8054

James Squier
Western Wisconsin Technical Institute
Business Division
Sixth & Vine Streets
LaCrosse, WI 54601
(608)785-9168

Peggy D. Loumos
Minnesota Curriculum Services Center
3554 Whitebear Avenue
Whitebear Lake, MN 55110
(612)770-3943

Truman Jackson
Minnesota Curriculum Services Center
3554 Whitebear Avenue
Whitebear Lake, MN 55110
(612)770-3943

Cecil Marck
CESA #6
725 W. Park Avenue
Chippewa Falls, WI 54729
(715)723-0341

MARKETING AND D.E.

Kenneth J. Nysted
UW-Whitewater
Whitewater, WI 53190
(414)563-6055

Richard F. James
UW-Whitewater
College of Business & Economics
4011 Carlson Building
Whitewater, WI 53190
(414)472-1322

Wilma Jean Alexander
Illinois State University
Department of BEA
345 Williams Hall
Normal, IL 61761
(309)438-7932

- -

HEALTH

Dorothy J. Douglas
UW-Madison
School of Nursing
Clinical Science Center
Madison, WI 53706
(608)263-5322

Martha B. Cuthbert
Fox Valley Technical Institute
Occupational Therapy Instructor
1825 N. Bluemound Drive
P.O. Box 2277
Appleton, WI 54913
(414)735-5662

Bruce DeBoer
Moraine Park Technical Institute
235 N. National Avenue
Fond du Lac, WI 54935
(414)922-8611 Ext. 253

David W. Sullivan
Moraine Park Technical Institute
235 N. National Avenue
Fond du Lac, WI 54935
(414)922-8611 Ext. 435

Kris Bosworth
UW-Madison
1225 Observatory Drive
Madison, WI 53706

Joel Worra
Academic Computer Center
UW-LaCrosse
LaCrosse, WI 54601
(608)785-8030

INDUSTRIAL

William A. Estrem
Illinois State University
Department of Industrial Technology
Normal, IL 61761
(309)454-1504

A. Tolu Honary
University of Northern Iowa
Cedar Falls, IA 50613
(319)235-4419

Leslie W. Alexander
Bloomington High School
Bloomington, IL 61701
(309)728-2644

Robert Zuleger
Wausau West High School
Wausau, WI 54401
(715)675-6692

Gene Szymaszek
Department of Industrial Education
UW-Platteville
Platteville, WI 53818
(608)348-8162

Richard Fritzon
Department of Computer Science
UW-Platteville
Platteville, WI 53818

Sandy Carmen
WBVTAE
4802 Sheboygan Avenue
7th Floor
Madison, WI 53707
(608)266-6764

- -

HOME ECONOMICS

Mildred Luckhardt
East Texas State University
Home Ec Department
Commerce, TX 75428
(214)886-8541

Daisy L. Cunningham
Virginia Polytechnic Institute
and State University
Home Ec Department
Blacksburg, VA 24061
(703)552-8373

Mary Hallquist/Beatrice Petrich
UW-Madison
120F Home Ec Building
Madison, WI 53706
(608)262-2660

Sharon Cooper
Colorado State University
Department of Vocational Education
Fort Collins, CO 80523
(303)491-6835

Laurie Hittman
CESA #6
725 W. Park Avenue
Chippewa Falls, WI 54729
(715)723-0341

Rollie Hicks
CESA #6
725 W. Park Avenue
Chippewa Falls, WI 54729
(715)723-0341

SPECIAL NEEDS/GIFTED

Mary Christianson
Wausau West High School
Wausau, WI 54401
(715)675-3351

Stephen Holden/Ron Doring/
Rick Lombard/Erica McIntire
District One Technical Institute
620 W. Clairemont Avenue
Eau Claire, WI 54701
(715)836-3966

Candy Oyler
Memorial High School
201 S. Gammon Road
Madison, WI 53717
(608)833-2020 Ext. 266

John Rendzio/Jamie Loehr/
Valarie Hanzelka
Area Education Agency 6
210 S. 12th Avenue
Marshalltown, IA 50158
(515)752-1578

VALPAR International Corporation
3801 E. 34th Street
Suite 105
Tucson, AZ 85713
(602)790-7141

- -

BASIC SKILLS

James P. Boyle
Ombudsman Educational Services, Ltd.
1585 N. Milwaukee Avenue #9
Libertyville, IL 60048
(312)367-6383

Larry Kaffine
North Central Technical Institute
1000 Schofield Avenue
Wausau, WI 54401
(715)675-3331 Ext. 343

Alvin "Al" Klug
North Central Technical Institute
1000 Schofield Avenue
Wausau, WI 54401
(715)675-3331 Ext. 343

Lois Gilliland
North Central Technical Institute
1000 Schofield Avenue
Wausau, WI 54401
(715)675-3331

Steven Miller
Lake Mills Area Schools
Lake Mills, WI 53551
(414)648-2358

Donna D. Thomas
Lake Mills Area Schools
Lake Mills, WI 53551
(414)648-2338

Samuel R. Filippone
Associate Professor in Mathematics
UW-Parkside
Kenosha, WI 53141
(414)533-2410

ADMINISTRATION

Joel Worra
Academic Computer Center
UW-LaCrosse
LaCrosse, WI 54601
(608)785-8030

Charles A. Speiker
Millard Public Schools
1010 South 144th Street
Omaha, NE 68154
(402)895-8216

Jeanette M. Richardson
Wisconsin Indianhead Technical Inst.
New Richmond Campus
New Richmond, WI 54017
(715)246-6561

Dennis Fredrick
Educational Research and Development
UW-Green Bay LC 805
Green Bay, WI 54302
(414)465-2338

Allan C. Hartley
Educational Research and Development
UW-Green Bay LC 805
Green Bay, WI 54302
(414)465-2338

Donald Leverenz
Wayne County Intermediate School Dist.
33500 Van Born Road
Wayne, MI 48184
(313)326-9300

- -

COMPUTER LITERACY

David M. West
Governor's Employment and Training Office
101 S. Webster - 6th Floor
Madison, WI 53707
(608)266-6886

Janice Patterson/Jack Wende
Wisconsin Center for Educational Research
785C Educational Sciences Building
1025 W. Johnson Street
Madison, WI 53706
(608)263-4200

Bob Houghton
Kettle Moraine Area Schools
P.O. Box 39
Wales, WI 53183
(414)968-2565

GRAPHICS

Greg Peck/Mark Murphy
Mexico Vo-Tech
905 N. Wade
Mexico, MO 65265
(314)581-5684

Walter G. Royek
Milwaukee Area Technical College
Graphics and Applied Arts
1015 North Sixth Street
Milwaukee, WI 53203
(414)481-7563

Robert Cavey/Dale Liebert
UW-Madison
Center for Educational Research
Madison, WI 53706
(608)263-5681

Edward R. Pope
UW-Madison
Art Department
6241 Humanities Building
Madison, WI 53706
(608)262-6334

Harley Kagerbauer
Milwaukee Area Technical College
1015 North Sixth Street
Milwaukee, WI 53203
(414)353-5109

Wan-Lee Cheng
University of North Dakota
Department of Industrial Technology
Grand Forks, ND 58202
(701)777-2197

Victor Langer
Milwaukee Area Technical College
1015 North Sixth Street
Milwaukee, WI 53203
(414)278-6247

WORD PROCESSING

Marianne J. D'Onofrio
Utah State University
College of Business
Logan, UT 84321
(801)750-2250

CAREER COUNSELING AND STUDENT SERVICES

Marguerite Mauermann
Beloit Public Schools
Beloit, WI 53511
(608)362-2218

Ron Nelson
Fond du Lac School District
Fond du Lac, WI 54935
(414)929-2747

Bonnie Lee Simms/Lyle Jensen
Salt Creek School District #48
1110 South Villa Avenue
Villa Park, IL 60181
(312)279-6160

Virginia S. Muenster
Fox Valley Technical Institute
1825 North Bluemound Drive
P.O. Box 2277
Appleton, WI 54913
(414)735-5720

Patricia Waldren
Wisconsin Career Information System
1078 Educational Sciences Building
1025 W. Johnson Street
Madison, WI 53706
(608)263-5094

Darcy Mellen-Sullivan/Linda Lucas
Wisconsin Career Information System
1078 Educational Sciences Building
1025 W. Johnson Street
Madison, WI 53706
(608)263-4748

- -

TOPICS OF INTEREST

Larry M. Dillingham
Moore-Norman Area Voc-Tech School
4701 12th Avenue, N.W.
Norman, OK 73069
(405)364-5763 Ext. 290

Jim Hunter
Blackhawk Technical Institute
6004 Prairie Road
Janesville, WI 53547
(608)756-4121

Shelley Foster
Fox Valley Technical Institute
P.O. Box 2277
Appleton, WI 54913
(414)735-5620

Jeffrey Stewart
Virginia Polytechnic Institute
and State University
215 Lane Hall
Blacksburg, VA 24061
(703)961-5471

Read G. Gilgen
UW-Madison
Laboratories for Recorded Instruction
279 Van Hise Hall
1220 Linden Drive
Madison, WI 53706
(608)262-1408

TOPICS OF INTEREST Cont'd.

Peter Braun
University of British Columbia
Pacific Learning Institute
2426 West 33rd Avenue
Vancouver, B.C.
Canada V6M 1C3

Dennis Wiser
Case High School
7345 Washington Avenue
Racine, WI 53406
(414)886-2716

Robert Ertl
Case High School
7345 Washington Avenue
Racine, WI 53406
(414)886-2716

Dr. Stapleton
MN

- -

VENDORS

Mark Detert/Fred Obernberger
Gregg/McGraw-Hill Book Company
1513 Delaware Boulevard
Madison, WI 53704
(608)249-0617

Roy Snell
Monroe Systems for Business
2743 University Avenue
Madison, WI 53705
(608)238-6386

Jackie Rust
Vanderlaan Software Systems
Route 3, Box 56F
Fontana, WI 53125
(414)275-3938

Robert L. Myers
Burroughs Corporation
P.O. Box 8640
Madison, WI 53708
(608)835-7055

Richard H. Ludwig/Tim Meekma
South-Western Publishing Company
Box 327
Fort Atkinson, WI 53538
(414)563-6768

Curt Johnson
Valpar International Corporation
3801 E. 34th Street - Suite 105
Tucson, AZ 85713
(602)790-7141

Wally Hoffman
Specialized Data Ssytems, Inc.
2117 Continental Lane
Madison, WI 53704
(608)241-5220

Dale R. Kirchner
L.A.B. Corporation
8101 Milwaukee Avenue
Wauwatosa, WI 53213
(414)258-6415

Steve Opperer
L.A.B. Corporation
8101 Milwaukee Avenue
Wauwatosa, WI 53213
(414)258-6415

THE VOCATIONAL STUDIES CENTER

University of Wisconsin-Madison

The Vocational Studies Center at the University of Wisconsin-Madison was reorganized with the support of the Wisconsin Board of Vocational, Technical, and Adult Education within the School of Education in 1971. The function of the center is to serve the State of Wisconsin in a unique way by bringing the resources of the University to bear on identified problems in the delivery of vocational and manpower programs—vocational education, technical education, adult education, career education and manpower training—to citizens of all ages in all communities of the state. The center focuses upon the delivery of services including analyses of need, target groups served, institutional organization, instructional and curriculum methodology and content, labor market needs, manpower policy, and other appropriate factors. To the extent that these goals are enhanced and the foci of the problems widened to encompass regional and national concerns, the center engages in studies beyond the boundaries of the state.

Merle E. Strong, Director
Roger H. Lambert, Associate Director

964 EDUCATIONAL SCIENCES BUILDING 1025 W. JOHNSON ST. MADISON, WI 53706